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THE CONVENTION OF THE ILLUMINATING ENGINEERING SOCIETY.

The convention of the Illuminating Engineering Society, held in Boston last week, may be considered as another test of the vitality of the society. When this, the youngest of the technical associations, was organized eighteen months ago, those who took active part in the organization were most agreeably surprised at the cordial support and encouragement with which their efforts were met. This enthusiasm, it was feared, would not last, though it was hoped that it would, at least, bring sufficient support to give the society a good start. When the formal organization was effected, a year ago last January, the prospects for success were good, but there was still some uncertainty whether sufficient interest would be kept up to secure that cooperation of the members, in presenting papers and taking part in discussions, which was necessary to make the society something more than merely an association of a few specialists without any influence or power. Happily, none of these fears was realized. After the organization, the society went forward and upward, its members grew in numbers and the work it did won recognition from all directions. Nevertheless, it was felt that the experience of the first year might not be repeated in the next, and President Sharp expressed this thought when, in accepting the presidency, he urged the members not to let their interest flag. The second year, he thought, would be a crucial one, which would show whether the society had vitality and stamina enough to hold its own and to go forward to a stronger position, as would be necessary if it were to carry out the work for which it was organized.

Again, these fears were to remain unrealized. A new constitution was adopted to meet the conditions developing out of the organization of sections throughout the country, and these were all put upon an equal standing; and it must be said that the various sections have done good work and have kept up the interest in the work throughout seven months of the second year, and, from all appearances, will take up the work again in the fall with renewed zeal. It is worthy of noting the success that has attended the reorganization of the society into a federation of sections, each on an equality with the others and under local management. The functions of the central organization are largely governmental, as, with the exception of conventions of the general society, the technical work is done by the sections. Such part of this work as is of general interest is then published by the society for the benefit of all sections. In no other technical society do the sections play such important parts, and it may also be added, in no other society have

the sections done such good work. The further working of this arrangement will be watched with much interest.

The success of the sections being assured, it was thought that it might be a good thing to hold a convention of the general society, so that members of the various sections might be brought together; and also, in order to call more attention to the society and to the work which it is doing. It was this convention that was held in Boston, and the marked success of the meeting demonstrates finally the earnestness of the members and their determination to carry on the good work and to spread the doctrine of good illumination throughout the land. The society must now be reckoned with. It represents all lighting interests and is not merely identified with one branch. Among its members are representatives of electric-lighting, gas-lighting, acetylene, lamp manufacturers, fixture manufacturers, architects, consulting engineers and scientists. Every phase of lighting problems is given attention. The membership is now over one thousand and at the convention 200 members and guests were registered; a most creditable record. Few technical societies can secure an attendance of twenty per cent at a convention.

Of the papers presented at the meeting, several were of much importance. The society represents an art as yet without satisfactory standards and units. Valuable discussions of the conditions thus arising and suggestion for improving them were given in President Sharp's address and the paper by Dr. E. P. Hyde. There were also papers dealing with the immediate problems of every-day work in illumination, and there were also discussions of experimental researches in problems of lighting. Thus the society has not only afforded means for those who have had experience to impart this to others and benefit by their criticisms, but it has also inspired members to undertake investigations with a view to throwing helpful light on little-understood phases of illumination. Work of this kind will surely tell in the end and will hasten the good day when lighting installations, however small, will be carried out with some understanding of the principles of what constitutes good practice, and the semi-barbaric conditions of the present day will be but a memory.

RAIL CORRUGATION.

More has been heard in Europe, and particularly in England, concerning rail corrugation than in this country, where it has given trouble in but a few instances. This is a roughening of the rail, a formation of waves, or corrugations, which occurs particularly on curves, and gives rise to very objectionable noise. Various explanations of this trouble have been offered, some attributing it to the composition of the rail, others to the mechanical treatment of the rails in the mill, and others again to the cars running on the track. This third view was taken in a discussion of the subject by Joseph A. Panton recently before the Institution of Electrical Engineers. He bases his conclusions on the following facts:

Rails from all makers became corrugated on his road, and these corrugations did not occur until electrical operation was undertaken. The corrugations developed in two or three years with new cars, and in two or three weeks with old cars. He believes it is caused largely by the common method of driving through a single gear and pinion, as he thinks that the forces thus thrown upon the truck throw it out of square, and thus skew the axles so that they slide upon and grind the rail.

His views were not accepted by all present. Professor Carus-Wilson said he did not see how the truck could be thrown out of true by the forces within it, although, of course, the driven axle might be twisted slightly with respect to the truck by the pressure of the gears. He thinks that the character of the ballast for the support for the rails has most to do with the trouble. Mr. W. M. Mordey thought that the corrugation was due to the softness of the rails, and said that his company had been forced to buy foreign rails, because the British makers could not come up to its specifications. Mr. W. W. Beaumont thought that the damage was done by the heavy pressure caused by the weight of the cars.

If trouble is caused by the car equipment, it may be expected to become more serious with increasing weights of cars and motors, unless means are found for correcting it. If it be shown to be due to unsymmetrical driving of the car axle, the remedy for this is at hand; for the armature may be either mounted on the axle itself, or double gears be adopted. Each of these solutions can be applied only with some mechanical difficulty, because the space between wheels is already somewhat limited, and gearless motors are not altogether suitable for light cars. Another way out of the difficulty would be to design a truck to meet these strains.

It is to be hoped that we may continue immune from the corrugated rail. Why this should be so, is not clear. The practice in the two countries is not sufficiently different to account for it.

HIGH-EFFICIENCY LAMPS AND THE CENTRAL STATION.

A question of immediate interest to the central station, and to the lamp manufacturers as well, is the effect of introducing the new electric lamps which require less power to produce as much light as the standard carbon incandescent lamp in use to-day. The development of the new lamps, some to the point of commercial availability, has been so rapid, relatively speaking, that the central stations have not had time to adapt themselves to them and the changes which would result from the introduction of a lamp taking only one-half, or one-third of the current required by the old lamp can not be predicted from experience gathered during the comparatively slow development of the older lamps.

Two immediate and opposite effects can be foreseen. The introduction of the high-efficiency lamps will, in the first place, tend to cut down the current output of the station. On the other hand, the economy resulting from the better efficiency of these lamps as sources of light should reduce considerably the cost of electric illumination and thus tend to increase the station output by securing more customers. Just to what extent

these will compensate, it is impossible to say. It is fortunate, in a way, that neither of these effects can be produced in a day, as not only will time be required to turn out the lamps in sufficient quantity to replace the old, but time will also be needed to build up the increase in customers, and this is likely to take longer than the other.

It seems probable, therefore, that the first effect of the new lamps will be a reduction of the station output, to be followed by an increase in business as soon as the lamps have demonstrated their economy. And it is well to note that much of the increase in load will necessitate additional outlay in distributing system, meters and other auxiliary apparatus, which, of course, will fall upon the central station.

The problem, however, is not as simple as that indicated, because the new lamps can not be put in on an entire system at once, and hence the lighting company must evolve some equitable plan for carrying out the change, for this duty will fall largely upon it, since it is still the custom in this country for the central station to furnish the lamps.

The problem, as is evident, is a delicate one for the lighting company, and yet is one which must be met frankly. Some suggestions for doing this were discussed by Mr. R. S. Hale in a paper read at the recent convention of the Illuminating Engineering Society, in which he looked at the central station's side.

THE SMOKELESS CITY.

The electrical engineer has an ideal before him of the city of the future from which the wasteful steam engine and the smoking factory and station chimney have been banished. He confidently anticipates that in this city of his imagination the electric motor will do all the work, illumination will be furnished by electric lamps of many kinds and, perhaps, some of the necessary heating may be done electrically. The power for this work will be supplied from waterfalls, or, if there be none available, from large power-houses placed well outside of the city proper.

There is no question that the city of the future will depend largely upon electrical energy for its motive power and for lighting, but there is a possible, or rather probable, competitor for much of the work of the smokeless city, and this is the gas-producer plant. Quickened by the competition of the electric lamp, gas engineers are bringing about changes in their methods and apparatus which are just as revolutionary as those which seem to be here in the electric field. The production of a satisfactory inverted Welsbach mantle lamp introduces a competitor which the incandescent lamp, even though of the most efficient type, must recognize and be prepared to meet. Moreover, the mechanical engineer has turned his attention to the gas engine again, and he has now eliminated many of the troubles of the earlier types; and since this motor not only has a high thermal efficiency but is itself a prime-mover, it is not handicapped by generating-station losses and this feature is a telling one where the cost of power is an important item.

Realizing the excellence of these devices and the advantage held by a system which supplies a cheap, clean fuel for heating, and, perhaps, underestimating the peculiar and desirable features of the electric lamps and motors, the gas engineer is now looking forward with as much confidence as the electrical engineer. He believes that the light and power in the ideal smokeless city will be supplied, largely at least, by means of producer gas made in large works outside of the city. The heating of the city will be done partly by gas, but mainly by the coke made in the producers, which is an excellent fuel when one knows how to use it, and is smokeless. The gas engineer does not expect to eliminate the electric lamp and motor entirely. For certain purposes, he recognizes their advantages, but he thinks they will take a subordinate position, or even where used they will be operated by current supplied from a gas-engine driven station; the main supply of energy will be by gas.

It must be admitted that the gas engineer can make out a pretty strong case for gas. The electrical engineer believes he can make out a stronger one for his system, and is counting on gas as an auxiliary, where water power is not available. It is very evident that these two systems will, in the future, cooperate largely in city work, yet it must not be overlooked that they will be competitors for much of this and it would be unwise for the electrical engineer to underestimate the strength of the gas system, if he intends securing for his own that part of the work which he thinks he should have. It would be better to overestimate the advantages of gas than to be led to a false feeling of security and thus left behind in the march of industrial development.

THE CAUSE OF THE INCREASE IN VACUUM OF CROOKES TUBES.

That Crookes tubes and other vacuum tubes show an increase in vacuum under continued use is a well-known phenomenon, which has been studied by various investigators, notably, Villard, R. S. Willows, and A. A. C. Swinton, the conclusions reached being that the gas remaining in the tube was, in some way, absorbed or occluded in the glass walls of the tube. The latest evidence on this subject, contained in a paper presented recently by Mr. Swinton to the Royal Society of London, seems to show that the effect is mechanical, rather than chemical.

Mr. Swinton had at hand certain old tubes which had been used several years ago and since then left open to atmospheric conditions. By heating pieces of these tubes, small bubbles of gas were driven off, giving the inner surface of the glass a clouded appearance. This gas was found to be mainly hydrogen. Next, pieces of these tubes were enclosed in an air-tight metal chamber which was exhausted. Then the glass was crushed when there was an immediate fall in the vacuum, showing, apparently, that the gas was held mechanically and not chemically. It would seem, from these experiments, that such tubes might be given better characteristics by making them of a very hard, dense glass and filling them, before exhaustion, with a heavy gas. This, however, would probably not do away with the necessity for special regulation under prolonged use.

The Post Falls Station of the Washington Water Power Company, of Spokane.

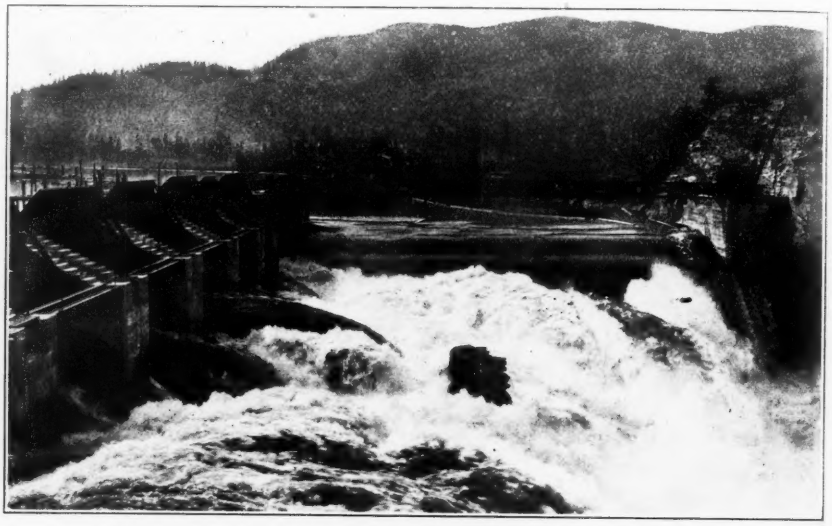
By H. Cole Estep.

AT Post Falls, Idaho, on the Spokane river, twenty-five miles east of Spokane, Washington, the Washington Water Power Company has built its new 18,000-horse-power hydroelectric station. The construction work was started in the fall of 1905, and the plant was finally completed in October, 1906, although it had been in operation since the preceding July. The station is the newest and finest hydroelectric plant in the inland empire district and forms an excellent criterion of the electrical engineering development of the region.

The river at this point has a flow varying from 20,000 to 1,100 cubic feet per second, the average being about 6,000 second-feet. Just above the falls is a large lake, forty miles long, which affords sufficient pond area to permit the plant to operate at full capacity throughout the entire year. The hydraulic head at the plant varies from fifty to sixty feet.

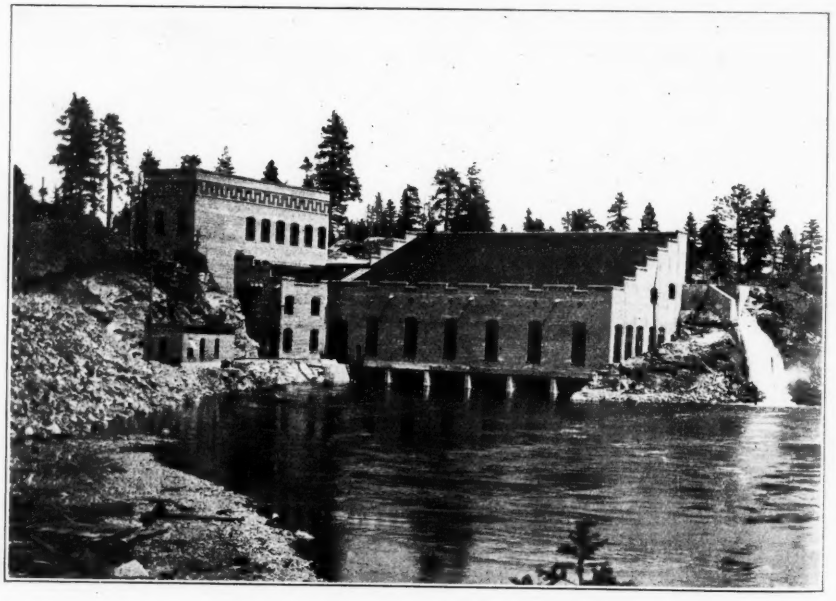
The topography of Post Falls is peculiarly adapted to the construction of a power station. Two islands a half a mile in length divide the river into three channels. At the lower end of the middle of these channels is built the power-house, while the north and south channels are blocked by concrete dams. The canyon walls of the river are high at this point, which made the construction of the dams comparatively cheap. The north channel dam is of the peculiar new design known as a "bear trap."

This bear-trap dam, which is one of the two now in existence in the United States, the other being at Taylor's Falls, Minnesota, is one of the features of the plant. It is a movable dam that can be fastened in position at any desired height according to the stage of the water. In case of flood the dam is lowered; in time of low water it is raised to its fullest height. The bear-trap dam proper at Post Falls is a reinforced steel structure, eighty feet long and twenty-five feet high, capable of being moved twelve feet vertically. The ends of the dam slide in vertical guides built into concrete abutments; the dam is raised or lowered by one man working through a system of gearing. The one at Post Falls has proved itself a reasonable success. On account of its length some difficulty has been experienced in handling it and it has shown a tendency to sag in the middle. It is now proposed to cut the dam in two, building a cement pier at the centre, and it is expected that the two small dams thus produced will be entirely successful and easily handled by one man.



POST FALLS STATION—BEAR-TRAP DAM LOWERED.

The Post Falls power-house is of plain brick, substantially constructed and absolutely fireproof. The building is L shaped; in one leg are installed the generators and turbines and in the other the transformers and the switchboard. Although the plant is in an out-of-the-way location some attention has been paid to the architectural features—a pleasing Egyptian serpentine border of inlaid pressed brick extends around the exterior of the power-house just under the cornice.



GENERAL VIEW OF THE POST FALLS STATION OF THE WASHINGTON WATER COMPANY.

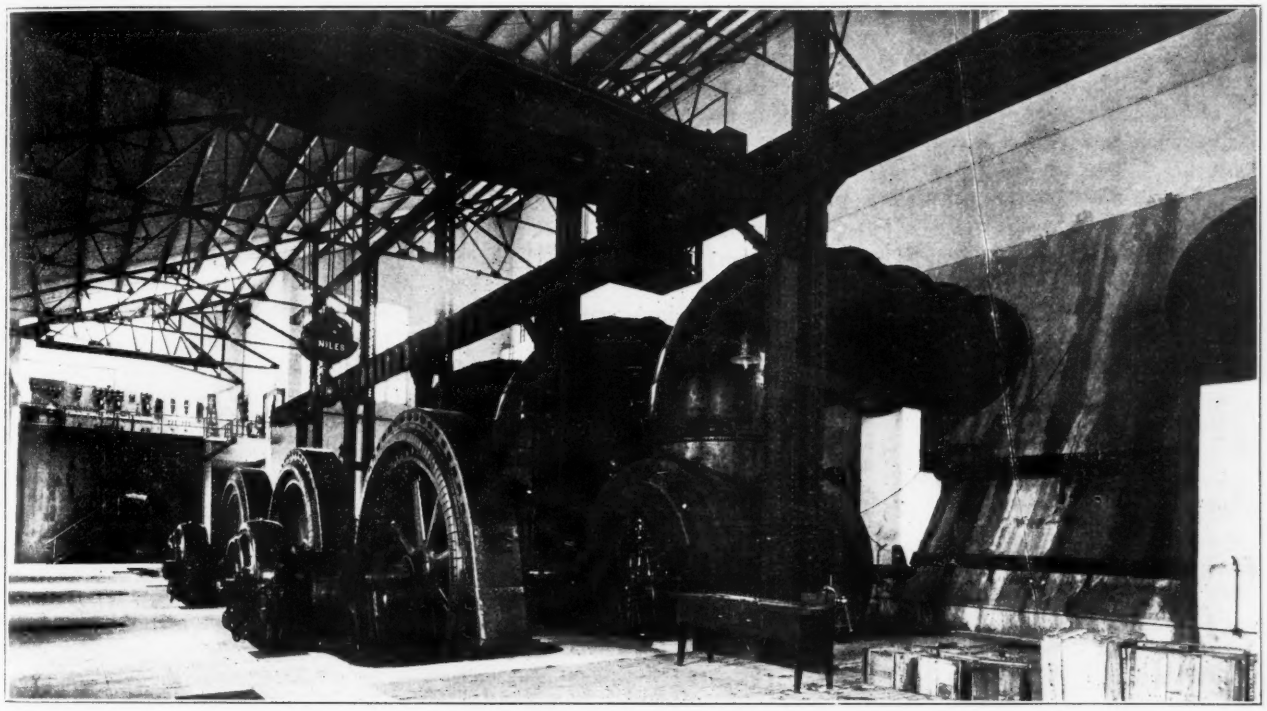
The present electrical equipment consists of three 2,250-kilowatt, 2,300-volt, 565-ampere, 138 revolutions per minute, three-phase, star-connected General Electric alternators, each driven by a 3,000-horse-power horizontal, direct-connected turbine, built by the Platt Iron Works

Company. The draft tubes of the turbines are ten feet nine inches in diameter at the wheel and twelve feet at the lower end. Space is left for the installation of three more units of equal capacity, one of which is now being erected. The ultimate output of the plant, with all units installed, will be 13,500 kilowatts. Two 125-volt, 480-ampere, 138-revolutions per minute, direct-current exciters, direct-connected to extensions of the main generator shafts, are used. These machines, besides exciting the main generators are used for auxiliary power and lighting purposes about the plant; they operate the head-gate machinery and the tools in the machine shop. The switching machinery and remote control signal service are operated by storage batteries which are charged from these machines.

Each of the generators is furnished with its own 2,250-kilowatt, oil-cooled, 2,300 to 60,000-volt, three-phase transformers, placed in separate fireproof cells. These cells are on the generator-room level, under the switchboard. A truck, that can be reached by the main traveling crane, is used to move the transformers. This layout is very compact and space-saving, but makes the handling of the heavy transformers rather awkward work.

Above the transformers is the switchboard gallery. The generators are connected to the usual style of oil switches, located at the back of the gallery, and controlled from the front of the switchboard through low-tension apparatus. The switchboard proper is of the benchboard type, a rather unusual design for a large plant, with one panel to each machine, and is fitted with the usual complement of apparatus, including a horizontal, edgewise frequency indicator and a power-factor indicator of standard General Electric design.

The oil switches are controlled from the front of the main switchboard by means of 110-volt, direct-current auxiliary apparatus. Green and red signal lamps, placed in the main switchboard, are used to indicate the position of the oil switches.



POST FALLS STATION—INTERIOR OF GENERATOR ROOM, SHOWING SWITCHBOARD IN BACKGROUND.

Considerable trouble was experienced with this signal system during the first few months of its operation. The plant was then operated in parallel with the Spokane station. The signal system was wired directly from the 125-volt exciters. The variation in the speed of these machines caused such variation in the voltage of the signal system as to make it practically useless; the signal lamps would burn out about as fast as they could be installed, and no dependence could be placed on the system. The trouble was remedied by the installation of a storage battery and a better quality of signal lamps. The system now used consists of a 110-volt storage battery which operates the signal lamps and all auxiliary switchboard apparatus, the battery being charged from the 125-volt exciters. This gives an absolutely constant potential for the operation of the switching machinery and has proven a very satisfactory arrangement; it is a design that is worth copying.

Lombard governors have been installed for the turbines and the plant no longer operates in parallel with the Spokane station. The Post Falls station is at present used entirely for supplying electrical energy for operating portions of the local interurban railway systems and for power service in the surounding mining region.

The plant has been in operation for nearly a year and is now giving entire satisfaction. Some interruptions to the service, especially on the 100-mile transmission line to Wallace, Idaho, have been caused by lightning. Electrical storms in these mountains come very suddenly, are usually short and exceptionally severe. Ordinary protection against lightning is not sufficient. The Post Falls station is protected by a double system of General Electric lightning arresters and choke-coils, and the transmission lines are fitted with more than the usual number of ground wires and protective devices.

The station was built under the personal supervision of C. S. McCalla, assistant general manager of the Washington Water Power Company.

THE CONCEPTS AND TERMINOLOGY OF ILLUMINATING ENGINEERING.[1]

BY DR. CLAYTON H. SHARP.

In the infancy of a science the concepts regarding it are necessarily neither very clear nor definite. The terminology of a science always lags far behind the actual state of the science itself. We must have the thing before we have a name for it—we must have the concept before we have a word to express it. An exact terminology, as contrasted with a loose one, is found to be more and more essential in proportion as its concepts develop and as the science itself progresses in exactitude. As long as the treatment of the science is qualitative only, no particular need is felt for an exact terminology. As, however, the science becomes quantitative and involves exact measurements of the quantities entering into it, the need for a terminology which is correspondingly precise is felt. For instance, in the earlier days of the science of mechanics, no strict differentiation was made between the terms force, work and power. At the present time, however, these concepts and the terminology corresponding thereto are very clearly differentiated. The interrelations of things are not seen in the same way when a science is young, as they are when it has, so to speak, reached its maturity. The simplest and most obvious relations are the ones which first are used, and it is only with advancing knowledge that the utility of the less obvious relations comes to be appreciated. This is true for an applied science as well as for a pure science. In the application of scientific principles and industrial products to the uses of every-day life, it usually happens that the practitioner at first proceeds in a purely empirical way. He is likely, however, very soon to find a need for greater exactitude in his work; consequently his terminology, which at first was of the crudest description, becomes more exact and perhaps more complex. His concepts of what he is working with, which at first are inexact and hazy, necessarily become cleared with time; and he finds that the ideas on which he proceeded at first, while they may have been more or less correct, yet are not the ones which are most useful in the more extensive practice which time has brought. It may be useful to illustrate these abstract ideas by a few concrete examples.

Going back into the history of electrical science and of electrical engineering, we find that the earliest electrical conception was that of a force, or tension or pressure. The idea of such a thing as a flow of electricity did not become established until after Volta's discovery and the pioneer work of Davy, Faraday, Ohm and others had brought this concept to light, and in Ohm's law a relation between the fundamental electrical qualities was established. It was very many years before the terminology of electricity became in any sense systematized or exact. When, however, electricity ceased to become a pure science and came to be applied to the very practical problem of artificial illumination, so that electric power was generated in large quantities and became a commercial product, the need for a terminology, and for units of measurement and for measuring instruments, all made themselves felt, and the terms volt, ohm, ampere and watt came quickly into existence and into the every-day language of the science.

The science of magnetism furnishes another example. The obvious thing about a magnet is its attractive force for other pieces of iron. This force is concentrated at points near the ends of the magnet, which points received the name of "poles." When investigators began to study magnets critically, the most apparent thing to do was to measure the force or strength of these poles. On measurements of pole strength the whole science of magnetism was based. The theory of magnetism, however, went on in its development, and the ideas of lines of force and of flux of magnetism were introduced. Later, when magnetic calculations became a feature in the commercial design of dynamos and motors, the old concept of pole-strength was found to be too awkward and cumbersome as a basis for making such calculations and had to be abandoned in favor of the newer one of magnetic flux, doubtless to the great temporary inconvenience of those to whom the pole-strength concept was a familiar one and the magnetic flux concept an unfamiliar one, acquaintance with which was to be gained only at the expense of considerable mental effort and inconvenience.

We are led now to ask what is the state or condition of the science of illuminating engineering in regard to its terminology and its concepts. This science is founded on the ancient science of optics. All the optical principles which apply to illuminating engineering have been known for many years. Optics is, in many respects, an exact science. The laws of reflection, refraction, diffraction and polarization have been studied with minute care. The measurement of wave-lengths and angles of rotatory polarization, as well as the computation of lenses, mirrors and other optical apparatus, have been carried to an extraordinary degree of precision. In spite of all this, however, the science of optics has remained in a rudimentary condition in so far as its terminology and concepts relating to light as an output, used for purposes of illumination, are concerned.

Just as in the case of magnetism, where the elementary notion of pole-strength was long regarded as the fundamental point of departure for calculations, so the strength or intensity of light sources has been the principal concept in dealing with light as a product. Until touched by the quickening hand of practical application, until illuminating engineering began to take its place as a quantitative science, measurements of the candle-power of luminous sources were all that were required, and by candle-power was usually meant the candle-power in a given direction. At the present time there are many signs that this branch of optical science is following the same course of progress which magnetism has taken before. Within a very few years the term "mean spherical candle-power" has come into use among engineers. This marks a distinct advance in the practical application of illuminating engineering, since it implies a recognition of the difference between a candle-power in a given direction and the average candle-power in all directions in space. The notion of intensity of illumination, as distinct from intensity of a luminous source, has become a familiar one and an awkwardly named unit for it has been used. These are sure indications of the practical progress of illuminating engineering.

What should be, or are likely to be, the lines of further development? These may be determined, in some directions, largely by action which our Committee on Nomenclature and Standards may take. In other directions this committee will be impotent, since it can not enforce the adoption of its recommendations in practice. The practitioner must feel the need of some novel term or idea before he will adopt such term or idea. Such a need is sometimes unfelt because the practical value of novel terms and concepts is not clearly enough recognized by those to whom they would be useful. Having this in mind, I desire to bring to your closer attention the bearing of some terms and concepts which have not, I believe, established themselves in the practice of illuminating engineering to the extent to

[1] Presidential address delivered at the convention of the Illuminating Engineering Society, Boston, July 30.

which their practical convenience and utility entitle them.

At the present time, in his quantitative work, the illuminating engineer deals chiefly with candle-power in its various aspects and with intensity of illumination. He does not, as a rule, employ any term which expresses directly the quantity of light which is being emitted by the source with which he is dealing. This is surprising, for the quantity of light which he has at his command is of vital importance to him. The distribution of this light he can arrange according to his own wishes by the use of various devices. Now the proper term for the quantity of light is easily found by a consideration of the physical nature of light itself. Light consists in ether waves propagated with a velocity of 300,000 kilometers per second. A source of light is simply a wave-maker. It agitates the ether continually and sends out a constant stream or flow of such waves in all unobstructed directions. If we take any transparent plane on one side of which is a source of light, we may think of a continual flow of wave-trains in the ether across this plane. If we surround our source of light by a closed, transparent surface, say an imaginary sphere, the total flow of ether-trains through this surface measures the luminous output of the source. For the sake of uniformity with the usages of other branches of physics, etc., the wave-flow is referred to by using the Latin name for flow, namely "flux."

We should form a concept, then, of all sources of light, whether primary or secondary, as the starting points of a luminous flux, and of all spaces surrounding such sources of light as traversed by this luminous flux. Having formed the concept of luminous flux, the following definitions and relations are a direct consequence: The output of any lamp is measured by the total luminous flux which it emits; the brightness of a diffusely reflecting or transmitting surface is proportional to the luminous flux which it emits per unit of area; the reflecting or transmitting power of such a surface is the ratio of the luminous flux which it emits to that which it receives; the intensity of illumination on any surface is the flux which it receives per unit of area. All the above quantities are of vital importance in illuminating engineering, in view of which fact it would be surprising if the concept of luminous flux should not prove itself to be very useful in the every-day work of the illuminating engineer.

It is necessary first to define a unit in terms of which luminous flux is to be measured and to establish its relation to the unit of luminous intensity, the candle-power. This is done in a way analogous to that employed in magnetism and electrostatics; that is, unit flux is defined as the flux emitted by a light of unit intensity, or one candle-power, in a unit solid angle. A unit solid angle is the solid angle subtended at the centre of a sphere by a portion of the surface of the sphere bounded by four lines, each equal in length to the radius of the sphere. There are $4\ \pi$ or 12.57 such solid angles in the entire sphere. This being the case, we have approximately the relation that a unit solid angle is the one subtended at a point by a surface one foot square one foot distant from that point, or by a surface one metre square one metre distant from the point, or a surface one yard square one yard distant from the point, etc. If at the apex of such a solid angle a light source of one candle-power be placed, a unit luminous flux will pass through any transverse plane through the solid angle, no matter what the inclination of the plane or its distance from the light. In terms of this unit, luminous flux is measured.

The relation between the total luminous flux of a source of light and the mean spherical candle-power of that source is at once seen. If we consider a source of light having an intensity of one candle-power in all directions, its mean spherical candle-power would be one; and since there are $4\ \pi$ solid angles in a sphere surrounding that source, the total flux from it will be $4\ \pi$ units of flux. If the mean spherical candle-power of a source is I_s, its total flux will be equal to $4\ \pi\ I_s$ or ϕ equals $4\ \pi\ I_s$, where ϕ represents the total flux and I_s the mean spherical intensity. Thus the total flux is numerically equal to 12.57 times the mean spherical candle-power of the source.

We have next to consider the relations existing between flux of light and intensity of illumination. As we have seen, the flux falling on a plane surface one foot square placed one foot distant from a light of one candle-power is approximately a unit flux. But the illumination on that surface is unit illumination if we measure in English units. If the same plane surface is removed to a distance of two feet from the light, only one-fourth of the total flux falls on it and the illumination is one-fourth as intense. In other words, the intensity of illumination on any surface is measured by the luminous flux per unit of that surface or by the flux density. This relation may be expressed thus: $E = \frac{\phi}{S}$, where S is the surface. From this relation the familiar inverse square law may at once be deduced.

The above equation becomes of practical importance in computing average illumination results. If, for instance, we know that from a given source or sources of light a certain flux falls upon the plane of reference, we can determine at once the average illumination on this plane by dividing the flux by the area of the plane. Thus the average illumination is determined without direct reference to the candle-power of the sources. Conversely, measurements of illumination on a given plane enable us to determine the flux of light falling on that plane. This is a quantity of great importance, since it leads us to a value for what we may term the net efficiency of the installation, or the efficiency of utilization of the light. By the net efficiency of the installation, or the efficiency of utilization, would then be meant the relation of flux which falls upon the horizontal plane of reference, to the total luminous flux emitted by the lamps in the room.

In order to make the use of the notion of luminous flux a convenient one in practical work of the computation of illumination, it is necessary to use it also with reference to the sources of light employed. In other words, when we wish to arrive at average values for illumination rather than exact illumination curves, we may ignore the candle-power and the distribution of the luminous intensity of the lamp and may start out from a value for the flux of light which the lamp, together with its reflector or globe, sends in the direction of the plane of reference. Multiplying this flux by the number of lamps, and dividing it by the area of the plane, we have approximately the illumination on the plane, neglecting reflections from walls and other objects. The effect on the flux of multiple reflections by the walls of the room can be found according to the usual procedure, that is, the flux must be multiplied by $\frac{1}{1-K}$, where K is the average coefficient of reflection of the walls and ceiling, and where this value is subject to large modifications according to the location of the lamps in the room. The maximum and minimum points of the illumination in a given installation can usually be told at a glance, and the values of these illuminations can be computed if required. The advantage of the procedure outlined above is that it gives an average value for the illumination over

the entire plane of reference without the necessity for going through the computation of the actual illumination at a large number of points in the room. The procedure for determining the value of the luminous flux from a lamp, either its total flux or the flux within a certain solid angle, is similar to that pursued in determining the mean spherical candle-power and mean hemispherical candle-power, etc. For instance, the well-known Rousseau diagram, so generally employed for the determination of mean spherical candle-power, is really a flux diagram. If the Rousseau diagram extends over 180 degrees polar distance, the total area which it encloses is proportional to the total flux of light from the lamp and the part which is enclosed between any two angles as marked on the axes of the abscissas, is proportional to the flux from the zone or from the solid angle. Consequently, any method which will yield the mean spherical, mean hemispherical, or mean zonular candle-power will give, with practically no modification, the luminous flux corresponding thereto. The Matthews integrating photometer may be calibrated so as to give directly the total luminous flux from the lamp measured by it, or other integrating devices may be employed. By the use of such devices as are at hand to-day, it would not be at all impossible to rate lamps according to their total luminous flux rather than according to their candle-power. Thus at one stroke the difficulty would be cleared up which arises from the actual difference in performance of incandescent electric lamps, which are rated alike according to our present arbitrary method. Using one of the methods indicated above, it is a matter of no difficulty to determine what the total flux of light will be, for instance, from a lamp with a conical reflector inside the angle subtended by the sides of the cone. Imagine, then, a number of lamps with such reflectors illuminating a room, and so placed that the angles of the cones of the reflectors do not in any case fall outside the boundaries of the plane of reference. Then the total amount of light which these lamps are throwing on the plane of reference will be approximately equal to the number of lamps multiplied by the flux which is sent out inside this plane, and as said above, the average illumination is obtained by dividing this flux by the area of such plane. This method is of such extreme simplicity that it seems that it ought to be developed in practice. It is concededly approximate, but since any method yields results which are so strongly affected by the reflections from walls and ceiling, it is a question whether an approximate method like this might not in the end yield results which are quite as reliable as those which are obtained by the more laborious calculations involved when illumination curves are computed.

Having pointed out certain reasons why the notion of luminous flux should find extensive application in illuminating engineering work, let us consider for a moment the question of terminology. We have at the present time a name for the unit of luminous intensity. We call that the candle, and we measure luminous intensities in candle-power.

It is usual in this country to express illumination in terms of the candle, and of the foot as the unit of distance. We have no suitable name for this unit of illumination; by some it is called the candle-foot, by others the foot-candle. Some make the plural candle-feet, others make it foot-candles. The name is inappropriate and awkward, since ordinarily, when we place two words in conjunction like this, we mean the product of the two quantities involved, as for example in foot-pounds, where we mean the product of the feet by the pounds. The foot-candle or the candle-feet, however, means candles divided by, not feet, but feet squared; consequently the term is doubly inappropriate. It would, therefore, be very desirable, if we are going to adhere to this unit of illumination, to have a suitable name for it. If we use the metric system, a name for the unit of illumination is at once at hand. In this system the candle may be the unit of luminous intensity, but the metre is taken as the unit of length. The illumination produced by one candle at a distance of one metre is called the "lux." On account of the relation existing between the foot and the metre, it happens that the lux is about ten times the size of the foot-candle. To be more exact, it is $\frac{39.37^2}{12^2}$, or 10.8 The use of the lux, however, involves the use of an unaccustomed unit of length and it is consequently found awkward. This is all a matter with which the Committee on Nomenclature and Standards will undoubtedly deal.

When it comes to the unit of flux of light, as we have seen, the unit of length does not enter. The unit of flux depends only upon the chosen unit for luminous intensity and consequently we may adopt the name which has already been suggested and used for this purpose, namely, the "lumen." By the lumen we mean the flux of light emitted by a source of one candle-power through a unit solid angle, and, as we have seen, the number of lumens falling on a surface, divided by the area of the surface in square feet, will give the illumination in foot-candles, or the number of lumens falling upon a surface, divided by the area of that surface in square metres, will give the illumination on that surface in lux. It would, therefore, seem to be an obvious thing to do to adopt the lumen as the name for the unit of luminous flux.

A point in terminology, which it may not be out of the way to bring up at the present time, relates to the use of the term "efficiency" in illumination work. We have in this kind of work at least three kinds of efficiency to consider. We have, first, the efficiency of the illuminant as such; second, the efficiency of the illumination installation irrespective of the lamp (this may be called the net efficiency of the installation, or the efficiency of utilization of the light); and, third, the efficiency of the installation including the lamp (this may be called the gross efficiency of the installation). The efficiency of the lamp, if it be an electric lamp, would properly be determined by its lumens per watt; this term has not come into use, but deserves to do so. Instead of lumens per watt, we speak of watts per candle. Watts per candle measures for a given type of lamp, the specific consumption of that lamp. True specific consumption would be measured by watts per lumen. The term watts per candle, while a very convenient one from the lamp-maker's point of view, is not so good a term for the use of the illuminating engineer. It is to be hoped, therefore, that in time lamps will be designated by their efficiencies, and the efficiencies will be expressed in terms of lumens per watt. What we ordinarily at the present day call a sixteen-candle-power 3.1 watts per candle lamp would, under that system, have a rating of 163 lumens and an efficiency of 3.3 lumens per watt. In the case of gas lamps, the efficiency could be expressed in terms of lumens per cubic foot per hour.

Going next to the net efficiency of the installation, irrespective of the lamp. This is the efficiency which it is the especial province of the illuminating engineer to attend to. Given any illuminants whatever, there is some best way to equip and to arrange them so as to produce a maximum result in illumination. This efficiency may be expressed in terms of the lumens received on the horizontal plane of reference, divided by

total lumens emitted by the lamps. The gross efficiency includes the efficiency of the lamps themselves. This is the efficiency with which the user of the installation, the man who pays the bills, is most interested. This efficiency can be expressed in terms of lumens on the plane of reference per watt, or per cubic foot per hour expended in feeding the lamps. In the *Transactions* of the Illuminating Engineering Society it has appeared that the need is felt for an expression of the gross efficiency of an installation, since the term foot-candles per watt per square foot has been used for this purpose. Those who have used this term have recognized its awkwardness as well as its usefulness, and it has even been proposed to give a name to this unit. If we stop, however, to analyze this expression, we see that foot-candles per watt per square foot is equivalent to foot-candles multiplied by square feet, and divided by watts. But, as we have seen, the foot-candles multiplied by the square feet gives the luminous flux in lumens, consequently the expression foot-candles per watt per square foot is equivalent numerically to lumens per watt; so that here again the introduction of the notion of luminous flux, and of the term lumen, justifies itself by reducing an expression of unusual complexity to one of very great simplicity.

This address as a treatise on the concepts and terminology of illuminating engineering is necessarily indefinite and incomplete. Its purpose is to point out the utility of certain ideas and names which should prove useful in the pursuit of the theory and practice of illuminating engineering. What the ultimate developments will be in concepts and terminology of the science can not be foretold; the most obvious steps in advance are those outlined above.

Centralizing Electric Supply in Sydney.

The advent of a municipal supply in the city of Sydney, Australia, has developed in a wonderful way the demand for electricity, says the *Electrical Engineer*, London, due no doubt to the reduced rates introduced: for though the city council is doing a business this year of over three million kilowatt-hours, the private companies are selling more than they ever did before. There are five such companies operating, all with overhead wires in separate districts, and having an aggregate of about 2,500 kilowatts of plant. The council, considering that the city would be better served by a centralization of the electricity supply business being placed under its own control, has concluded an agreement with the Empire Electric Company, Limited, by which the latter agrees to transfer all its customers to the council's mains. This company has been most successful during the past ten years, and the transference of its business will add another million units to the council's output.

General Electric Concealed Assets.

While the investment public has long been trained to take cognizance of concealed earnings or equities in judging the value of railroad investments, no such rule has been generally applied to industrials, particularly manufacturing corporations. And yet the General Electric Company, says the *Wall Street Journal*, possesses several substantial kinds of concealed assets, the extent of which are but little understood or appreciated.

For instance, the company has an undoubted equity of great value in its patents, which are now carried on the books at the nominal valuation of $1, in spite of the fact that in the eight years ended January 31 last the company expended in acquiring new patents and defending patents already acquired, a total of $6,135,329, besides $2,000,000 written off of patent account during the 1906 and 1907 fiscal years. This is an aggregate of $8,135,329, which the company has expended and charged either directly to operation or to surplus earnings in the last eight years, and against which not a dollar of capitalization has been created.

Further than this, the company still receives some income from royalties charged to concerns which are given the expany's patents within a specified territory. The amount of these royalties was at one time very large, about $750,000, but during the last few years the income from this source has been steadily declining. It was the recognition of this, coupled with the fact that the life of the patents is constantly decreasing, which led the directors to adopt the conservative course of writing the entire patent account off the books.

The General Electric Company in 1894 carried its patent and franchise account at $8,159,264. The odd amount was written off during the 1896 year, leaving the account at $8,000,000. Of this, $4,000,000 was charged off in 1899-1890. No further reduction of the book account was made until 1906, when $1,000,000 was charged to earnings, and the remaining $1,000,000 was written off during the year just ended.

It is probably impossible to place a monetary value on the company's equity in its patent account. That it is of substantial proportion is well indicated by the statement that since the close of the first fiscal year, January 31, 1893, the General Electric has expended for acquiring new patents and in patent litigation $8,417,551, and has charged off for patents account $8,277,415. This is a total of $16,694,966 expended in fourteen years and is equivalent to better than twenty-five per cent on the stock outstanding January 31, 1907.

The Specific Resistance and Temperature-Coefficient of Tantalum.

The *London Electrician* gives a translation of a study of the specific resistance of tantalum wire, by Marcello Von Pirani, from which the following information is taken:

It appeared to be of scientific interest to determine whether the wide differences in the specific resistance of various pieces of tantalum at white heat in vacuo were maintained, or in what manner they vary or whether it is possible to fix a uniform value for the resistance of pure tantalum in this manner.

For this purpose wires of various thickness were selected, the initial resistance of which deviated as much as possible from the mean value.

The following table gives the thickness and specific resistances of the wires experimented upon:

Diameter. Millimetre.	Specific Resistance.
0.049	0.173
0.0505	0.18
0.06	0.175
0.126	0.188

The wires were heated in a very high vacuum to a temperature of about 1,900 degrees centigrade, from 100 to 200 hours, and then taken from the receptacle in which they were melted down, and, after re-drawing, measured afresh, with the result that all wires were found to have the same specific resistances, but considerably below the previous average value. The results were as follows:

Diameter. Millimetre.	Specific Resistance.
0.049	0.147
0.0505	0.145
0.06	0.147
0.126	0.145

The temperature-coefficient had risen to 0.33 per cent, per one degree centigrade, between 0 degree centigrade and 100 degrees centigrade. The temperature-coefficient of another wire 0.05 millimetre thick, heated for some long time in vacuo, was tested between the temperature of liquid air and room-temperature, the average result being 0.32 per cent per degree.

If the temperature of tantalum wire in the tantalum lamp running at 1.5 watts per candle be taken as 1,750 degrees centigrade (a temperature fairly nearly approaching the actual temperature), it is found that, since the resistance at this temperature is six times as great as at room-temperature, the average temperature coefficient is 2.9 per cent (500 per cent at 1,730 degrees).

The average values of 0.146 cited as the specific resistance and 0.33 as the temperature coefficient between 0 degree and 100 degrees would appear to be characteristic for pure tantalum.

Illuminating Engineering Society.

The First Annual Convention Held at Boston, July 30 and 31, a Noteworthy Success.

THE first convention of the Illuminating Engineering Society was held in Boston on July 30 and 31. This was during the celebration of Old Home Week, so that there were many features of entertainment going on in that city. Possibly this had something to do with the excellent attendance at the convention, but, however this may have been, other indications show that the interest in the work of this, the youngest technical society, is not flagging.

At the opening meeting, it was announced by the secretary that the membership had reached the very creditable figure of 1,047. Bearing this in mind, it is surprising to learn that there were registered during the meeting two hundred members and guests. This percentage of attendance will bear comparison with that of any other technical organization.

The convention was held in the library of the new building of the Edison Electric Illuminating Company of Boston. This building is on Boylston street, conveniently located and admirably adapted for such a meeting; for, besides the excellent arrangement of the rooms, the method adopted for lighting it was, in reality, a working exhibit of the aims of the society. The library is on the third floor of this building. Temporary headquarters were established on the seventh floor, in the assembly room, where all comforts were provided for the members.

The first session was called to order at 10.30 o'clock, Tuesday morning, by John Campbell, chairman of the general convention committee, who turned over the meeting to President C. H. Sharp. A brief report of this meeting was given in the ELECTRICAL REVIEW, August 3.

The first business was an address of welcome to the commonwealth by Governor Guild, which was followed by a similar welcome to the city of Boston by Mayor John F. Fitzgerald. The latter, in his address, dwelt appreciatively upon the work done by the electrical engineer, sketching briefly some of the most noteworthy accomplishments of this profession.

This address was followed by the president's address, delivered by Dr. Sharp. The theme was "The Concepts and Terminology of Illuminating Engineering." In it, attention is called to the state of confusion which now exists, the need for adopting certain ideas, such as "a flux of light," and to the acceptance of several units. This address is given in full on another page of this issue.

The discussion was opened by V. R. Lansingh, who said that the address gave him something definite to work with—that the methods proposed should be adopted. He pointed out that the recent action of the National Electric Light Association, in adopting specifications for street lighting, is moving in the direction indicated.

J. R. Cravath endorsed Dr. Sharp's suggestion, but did not think it was yet time to throw over the term "foot candle," as some definite concept of utilization is needed.

The second paper was by Dr. Edward P. Hyde, the title being "Primary, Secondary and Working Standards of Light." Dr. Hyde discusses briefly the different standards in use by the different lighting interests of this country and of Europe, calling particular attention to the disagreement between the units employed by the gas and the electric interests. He defines clearly the requirements of the three kinds of standards. A primary standard must be reproducible. A secondary standard must remain constant over a long time, and a working standard remain constant during fairly long intervals of use. There is no objection if any one kind of standard is also suitable for use as another, but, in seeking a primary standard, for example, one should not limit himself by the question of the cost of the standard or whether it will operate through long periods. The secondary and working standards should, of course, be inexpensive. Dr. Hyde, in conclusion, urges the importance of action looking toward the adoption of an international standard of light. The American, English and French units are sufficiently close together to make a compromise easy. Unfortunately the German standard, the hefner, differs rather too much.

In opening the discussion, Dr. Louis Bell said that the work of the society is made most difficult, because it represents an art without a standard. It thus is in danger of standing for pseudo-accuracy. He pointed out the difficulty of measuring the intensity of sources of light, and said that that encountered when measuring intensity of illumination is tenfold greater. The proper way to improve conditions is to adopt certain units and standards, and the suggestion made by Dr. Hyde should be the first step. The society, representing as it does an art and not being affiliated particularly with any one branch of illumination, besides having an international character, due to its foreign members, is a very proper body to undertake bringing about international action.

P. S. Millar, to illustrate the excellence of incandescent lamps, when used as secondary standards, said that the General Electric Company had set aside in 1889 a number of lamps to be kept as standards. These had been sent to the Physikalische Technische Reichsanstalt in Germany, and calibrated. Recent tests made of these lamps show that they had not varied since that date more than one per cent, and probably not more than one-half per cent. It is noteworthy that the standards employed in electric lighting have not varied since 1889. He questioned whether the gas engineers appreciate the convenience of the incandescent lamp, both as a secondary and working standard.

Dr. A. E. Forstall, in reply to Mr. Millar, said that, as pointed out by Dr. Hyde, flame standards are necessary in gas measurements, because the gas flame is affected by atmospheric conditions; and it would not be fair to employ a standard which was not also affected similarly. He pointed out that, in this country, the pentane standard is used as a working standard, but not as a primary.

Dr. Hyde rather differed on this point, thinking that the pentane is used as a primary standard.

C. O. Bond said that a meeting is being held now in Zurich, Switzerland, of the Society for Incandescent Photometry, which is now considering this question of primary standards. He said that the United Gas Improvement Company, of Philadelphia, has been using the incandescent lamp to determine the effect of atmospheric changes on flame standards. Some years ago, Methven called attention to the fact that small flame standards are affected more by atmospheric conditions than are large ones.

President Sharp said that too often inaccuracy in photometric measurements

is blamed to the eye, when it should be charged against uncertain standards or poor methods. He asked, if all of the present standards should be lost, would it be possible to get back to the original value by making a large number of incandescent lamps, computing their candle-power, and then measuring them, taking the average of these values?

Replying to this question, J. T. Marshall said that, by making one thousand lamps a week for several successive weeks, taking the average of all of these, it would be possible to get back to the standard value very closely.

J. E. Woodwell said that Dr. A. Blondell had taken up the matter of securing some agreement regarding a standard in France, and purposes submitting the results of his conference with lighting interests in that country to the Zurich conference.

In closing the discussion, Dr. Hyde said that positive action should be taken by the society, through its committee on nomenclature and standards, toward securing an international standard. The longer this is put off, the harder will it be to come to an agreement.

TUESDAY AFTERNOON SESSION.

At the afternoon session, opened at 1.15 o'clock, L. H. Scherck, in a paper entitled "Illuminating Engineering and Central Station Practice," pointed out the importance to the central station of using proper methods of illumination. Although the business of the station is to supply the energy used for producing the light, and it can not properly be blamed if the method of utilization is poor, nevertheless, due to the peculiar relations which it holds in the public's estimation, the blame will be laid on it for any dissatisfaction. It is to its best interest, therefore, to watch all installations, to be prepared to give advice when it is asked, and even to criticize, when it sees improper methods employed. Large companies could well afford to employ illuminating engineers for this purpose. Smaller companies could probably handle the matter best if their solicitors make a study of the principles of illumination. When complaints are made, they are nearly always due to extravagant use of current; and the best interests of the company will be promoted, if, in such cases, the extravagance be pointed out, and the customer be shown how he can get better results at a less cost.

C. E. Knox presented a paper entitled "Illumination of the Engineering Societies Building." In the absence of the author, this was read by F. R. Nugent. It describes, in some detail, the method employed in this noteworthy installation in New York, and gives the results of measurements made to determine the results thus secured.

The discussion of this paper, in which J. E. Woodwell, V. R. Lansingh, A. J. Marshall, F. W. Willcox and L. B. Marks took part, turned upon certain details of installation, it being asked what were the watts per square foot in certain rooms, and on what basis the estimates had been made.

Replying, Mr. Nugent said that the basis was the candle-power per cubic foot of space, the particular value adopted in each room depending upon the experience of the engineers in charge. These values varied from 400 to 1,800 cubic feet to each sixteen-candle-power lamp.

C. H. Stone read a paper on "The Present Status of Candle-power Standards for Gas." This explained in some detail the stand taken by the New York public service commission regarding the candle-power which should be required by the different gas companies of the state.

This paper was discussed by Dr. Forstall.

T. J. Litle, Jr., in a paper entitled "The Inverted Gas Light," described the "reflex" burner which has been developed for use with the inverted Welsbach mantle. He pointed out the peculiar features of this burner, one being the automatic gauze, which prevents flashing back when the gas is lit, and then opens, leaving a clear passage for the gas, this being essential, because, if the gauze were always in position, it would soon be clogged with dust. Installations in which this type of lamp has been used with good results were described.

This paper was discussed by Dr. Sharp, C. O. Bond and V. R. Lansingh, the former saying that the inverted burner is the gas engineers' reply to the new high-efficiency incandescent lamps.

Mr. Lansingh pointed out the advantage of the new burner in respect to its distribution of candle-power.

A paper entitled "Acetylene," by A. C. Morrison, in the absence of the author, was read by title.

This was followed by a paper on "Acetylene Lighting," by Nelson Goodyear, in which the author discusses the peculiar features of acetylene as an illuminant which makes it admirable for certain purposes. He describes the requisites of a good generator and also the types of equipment which are now available.

Mr. Lansingh, in opening the discussion, agreed with the author regarding the good quality of the light from acetylene, but said that the intrinsic brilliancy is too intense. Acetylene should never be used without a diffusing globe; yet this is seldom used.

Mr. Litle said that, in comparing acetylene with gas, the author had taken the old type of flat flame. If the comparison were made with the Welsbach burner, very different conclusions would have been reached.

Replying, Mr. Goodyear said that acetylene is not as yet used much with incandescent mantles, but it has been tried, with excellent results; and values as high as 140-candle-power have been obtained with the consumption of one cubic foot of gas an hour.

Dr. Charles H. Williams read a paper on "A New Comparison Photometer." This is an instrument designed particularly with a view to portability. The standard is a miniature incandescent lamp, which lights a translucent screen. A second screen is illuminated by light from the surface, the intensity of which it is desired to measure. By means of a deflecting prism, these two illuminated fields are brought into juxtaposition. Two graduated absorbing screens are placed in front of the two fields, these screens being merely photographic negatives, in which the density of the screen varies in geometric ratio from one end to the other. To use the instrument, it is first directed towards a surface, usually of white cardboard, the illumination of which is known. Then the screen in front of the standard lamp is shifted until a balance is obtained. The position of this screen is noted, and, if the lamp does not vary, by bringing the screen back to the same point, the same intensity of illumination of the screen by the standard can be obtained at any time. The instrument is then directed toward the surface, the intensity of which it is desired to measure, and the screen in front of that is shifted until a balance is obtained. The scale then read indicates directly, in candle feet, the intensity of illumination. This is supposing that the intensity being measured is greater than that of the standard screen. If it be less, the screen in front of the standard must be adjusted so as to reduce that illumination. When a balance is thus found, the position of that screen indicates the intensity of illumination. The instrument is small, and easily carried in one hand. The largest part of the equipment is the storage battery for supplying a small lamp.

P. S. Millar presented a paper, entitled

"Illumination Photometers and Their Use." In this he lays down the requisites of the ideal photometers, and describes eleven instruments devised by various engineers. A table has been compiled, in which the characteristics of these photometers are given, such as sensibility, type of standard employed, the method by which a balance is obtained and the correct or incorrect arrangement of the instrument, according to the author's ideas. He concludes that those instruments which he has rated as having a low sensibility may give correct results within six to ten per cent; that errors of from three to five per cent, due to the use of a flame as a standard source, may occur; that improper design may introduce errors of from twenty to twenty-nine per cent. He believes that illuminating engineers should strive toward greater accuracy, and, at the same time, should not blame the science for defects of instruments and personal errors.

The discussion on this paper was rather animated, as a number were present whose instruments had been referred to. It was contended by several speakers that the comparisons were not quite fair, as certain of the instruments had been designed for special purposes, for which they were well suited.

Respecting the general difficulty of making measurements of illumination, Dr. Louis Bell said that no one who has not attempted this realizes the troubles. The more time he spends on this work, the more trouble does he encounter. Measurements of illumination are far more difficult than measurements of the intensity of a single source. The difficulty here lies in the many directions from which the light falls upon the surface under consideration, and this difficulty is not to be dodged by the adoption of the ideal photometer outlined by Mr. Millar or any other. Where angles of incidence are fairly large, Lambert's law fails, because the screens are not true surfaces. All comparison screens break down at these angles. Regarding the screens available to-day, Dr. Bell quoted the words of the psalmist, "There is none righteous; no, not one." Where absorbing screens and diaphragms are employed, results may be good; but the apparatus is difficult to control.

Others who took part in the discussion were G. H. Stickney, J. T. Marshall, W. D'A. Ryan and L. B. Marks, the latter agreeing with Dr. Bell, who thought it inadvisable to advertise the deficiency of the illuminating engineers' apparatus.

In closing the discussion, Mr. Millar defended the figures which he had given respecting the performance of the different instruments tested.

A paper by A. F. Parks, entitled "A Graphic Illumination Chart," was, in the absence of the author, read by V. R. Lansingh. This describes a graphical method of computing intensities of illumination, and gives a chart enabling these values to be obtained directly, when the sources of illumination are known.

P. S. Millar read a paper, entitled "The Elements of Inefficiency in Diffused Lighting Systems." In this, the author sought to obtain a comparison between direct illumination, by means of incandescent lamps placed on a fixture overhead, and diffused illumination, in which similar lamps were arranged so as to throw the light from the fixture upon the ceiling. The ratio of the effect produced by the direct lighting was, in this case, 0.19; that is to say the efficiency was about twenty per cent. Mr. Millar also made measurements of the diffused and direct systems as installed in the Harlem office of the New York Edison Company. In this case, the ratio was thirty-two per cent. He then gives figures intended to show the relative utility of the two systems; that is to say, the relative intensities of illumination required to enable reading to be done with the same ease by the two systems of lighting. Experiments with various observers show that when diffused lighting is used, the illumination on the page being read must be greater, it being thought that this was due to the fact that, with the diffused lighting, the ceiling and walls are more brilliantly illuminated than the page being read. An average of ten observers showed that, with direct lighting, 2.7 foot-candles were satisfactory, and with diffused lighting, 4.45 foot-candles, indicating that the direct lighting was sixty-five per cent more efficient than the diffused. These figures, of course, apply only to that particular installation. The author comes to the following conclusions:

In diffused lighting systems of the class considered, where the illumination of the working flame is one of the prime objects, a large proportion of the light is lost. That which is not lost, becomes less effective. Brilliant illumination is produced where it is useless, and even undesirable: and conditions are established which create a demand for an unduly high intensity of illumination on objects viewed.

L. B. Marks, in opening the discussion, said that such studies of illumination problems were needed. However, he did not think that the figures for efficiency given in the paper would hold for other installations properly designed. He did not think that, in the system used in the Boston Edison new building, the light lost was more than thirty per cent. He thought that architects often prefer an illumination of lower intensity—why, he did not know. However, in all cases, some side lamps seem to be required.

J. R. Cravath disagreed with Mr. Marks, as he did not think architects approved of the diffused system.

Mr. Millar said that no system can be judged properly by merely looking over it—measurements must be made.

WEDNESDAY MORNING SESSION.

The third session of the convention was opened on Wednesday morning at 9.30 o'clock.

A paper by C. Howard Walker, entitled "Electric Light as Related to Architecture," was read by the author. In this, certain principles of illumination are laid down, particular stress being laid upon exterior lighting. It was shown that discrimination must be used. If a building is architecturally good, great care is necessary, because when illuminated at night, the conditions differ entirely from those of daylight, for which the building was designed. Frequently, the system adopted lights brilliantly those features of the building which were intended to be dark, and throws into shade those supposed to be lighted. Thus, the entire effect is reversed. On the other hand, if the architectural design is poor, the building may properly be employed as a support for a lighting display, which really masks the structure itself. It should be remembered that electric lamps, at night, are merely bright points surrounded by a faint penumbra; and, when placed on a building, they are apt to conceal it entirely, the result being a skeleton outline of the structure. Another point to be remembered is a lack of atmosphere at night. The eye can not judge the distance of a source of light. This has the effect of closing up horizontal distances, and emphasizing vertical. A tall building appears much higher at night, while a long arcade is greatly shortened. To avoid this, vertical lines of lamps should not be used. Buildings should be lighted by horizontal bands of lamps, properly graded in intensity, to give the desired effect. Long arcades should be marked with continuous horizontal lines of lamps, care being taken to avoid breaks, because there is no visible support for the lamps; therefore, the skeleton must be continuous. It is best,

when possible, to use reflected light for illumination. When, however, direct light is employed, entirely new effects are produced. The lamps themselves are beautiful, and, therefore, good for their own effects.

When color effects are attempted, white must be mixed with the other colors; otherwise the illumination appears dim. Red lamps alternated with white are much better than red alone. Large lamps, or clusters of lamps, should be placed on the main features of the building. Within the building, the architectural standard should be observed; and properly placed cluster-lamps are better than lamps strung out, unless the latter are so close together as to become practically continuous.

Referring to the diffused system of lighting by means of lamps concealed within a cornice, Mr. Walker said the objection to that architecturally is that the band of light surrounding the entire ceiling separates this from its supports, leaving it apparently floating in the air. On the other hand, the bottom of the beams were dark, so that the supporting columns apparently are holding up merely boards. To get around this, the lamps should be arranged so as to light up, partially at least, the supporting beams, and the columns should be brought out to the edge of beam. The break between beam and ceiling should be avoided.

The paper was discussed by J. R. Cravath, F. W. Willcox, E. P. Hyde and J. E. Woodwell.

Dr. Louis Bell read a paper, entitled "Lighting the Boston Edison Building," presented by himself, L. B. Marks and W. D'A. Ryan. This describes in detail the various lighting features of this building which had been laid out by the authors, who formed a commission selected to plan the installation. On account of the purpose for which it was intended, various systems of illumination were installed in different parts of the building. Due to the peculiar shape of the building, it being narrow and high, the exterior lighting had been designed to avoid emphasizing the height.

The paper was discussed by V. R. Lansingh, F. W. Willcox, C. H. Williams, J. E. Woodwell, P. S. Millar, J. R. Cravath and A. J. Marshall, who asked questions regarding certain features of the lighting, these being replied to by the authors.

W. H. Blood, Jr., presented a paper on "What is Street Lighting?" In this, the author lays down certain principles for street lighting. The three objects are to eliminate crime, to facilitate transit, and decoration. For these purposes, uniform illumination is best, and this is most satisfactorily given by many small units. He believes better results are given by incandescent lamps than by arc lamps, and anticipates a marked advance in this direction, due to the new high-candle-power, high-efficiency incandescent lamps.

Instances were recited where incandescent lamps had been used for street lighting, particularly in Los Angeles and St. Paul. He thinks there is a tendency toward greater illumination, and also a tendency to abandon the arc lamp, substituting instead of it incandescent lamps of from forty to sixty candle-power.

In cities, the illumination of these lamps should overlap. In the country, the lamps are intended merely to indicate the road, and may, therefore, be small and far apart.

J. R. Cravath agreed regarding the desirability of the system outlined by Mr. Blood, but believes that the cost is a serious objection.

F. W. Willcox did not see why the electric lighting companies were not as able to supply frequent posts as are the gas companies.

V. R. Lansingh pointed out that this is being done in certain cities. He also called attention to the new types of globes for street lamps, which throw the greater part of the light up and down the street, reducing the amount thrown sideways.

J. E. Woodwell said that the plan proposed by Mr. Blood had been worked up for the public buildings in St. Paul, but had not been adopted on account of the expense.

T. J. Litle, Jr., said the plan as outlined agreed well with that employed by the gas companies, in which sixty-candle-power Welsbach lamps are used, alternated on the street.

W. D'A. Ryan thought that the high-candle-power incandescent lamps would improve street illumination, but the time is not ripe for an abrupt change. The arc lamp has a high efficiency, and is not yet to be set aside.

Referring to the Los Angeles installation, Mr. Ryan said that the effect was good, but the expense high, the energy used there being about six times as great as that which would be required to produce the same illumination by means of arc lamps.

In closing the discussion, Mr. Blood said that his main plea was for greater uniformity in street illumination.

J. S. Codman read a paper entitled "Check on Reliability of Photometric Curves." This describes a test made by the author to determine whether the distribution of light about a cluster of lamps could be estimated approximately by taking the distribution around the individual lamps and combining these. A certain cluster having one lamp at the bottom and five above, in a circle, was chosen. Each lamp was surrounded by a shade. By combining the photometric curves for the individual lamps, a resultant curve for the fixture was obtained. This was compared with the curve as actually measured while the fixture was being rotated. The results of the comparison were satisfactory.

Dr. Louis Bell presented a paper on "Coefficients of Diffused Reflection." The author points out the unsatisfactory condition of our knowledge of coefficients of reflection. Values are frequently used which are much too high. To obtain reliable data, samples of wall paper of many colors were secured, and their coefficients measured. The results varied according to the color of the reflecting surface and the color of the light. As a standard, white cardboard with a matte surface was taken. The results show that strong colors give lower coefficients than is generally believed. The best results, excepting, of course, white, are given by faint creams and light yellows, the coefficients, in some cases, being as high as 0.64. Dark green absorbs the greatest amount of light, the coefficient in this case being as low as 0.05. As a general rule, light creams and yellows give coefficients varying from 0.4 to 0.6. The medium colors come next, with coefficients from 0.2 to 0.4, the dark green and red give coefficients varying from 0.15 to 0.05.

Incandescent lamps generally give lower coefficients of reflection than daylight from a clear sky through a north window, though with yellows and greens, the coefficients may be a little higher. Grays kill the light most noticeably. Browns are bad.

The texture of the papers used was, in general, rather silky; but this seemed to have little effect upon the reflection.

It is well to remember the large loss of light caused by the dark colors, since these are to-day the popular shades. The angles at which the reflection had been measured were about normal.

A paper on "The Metallic Flame Arc" was read by C. E. Stevens. This described a type of arc lamp using oxid of iron as one electrode, by means of which the flame becomes luminous. This lamp was described in the ELECTRICAL REVIEW, June 15.

W. D'A. Ryan pointed out the value of lamps of this type, which is the peculiar

curve of distribution that they give. The highest intensity lies about ten degrees below the horizontal. As the lamp is approached, the candle-power diminishes, and is thus easy on the eyes.

A paper by R. S. Hale, entitled "New Lights and New Illuminants from a Central Station Point of View," was, in the absence of the author, read by V. R. Lansingh. It discussed the effects of the high efficiency of lamps upon the business of the central station. This paper is printed on another page of this issue.

In the discussion, F. W. Willcox said that this question is one of great interest to the central stations at this time. He thought the problem might best be solved by a change in rates, as there is always less objection to an indirect charge than to a direct one.

This closed the business meetings of the society, and the usual resolutions, thanking the local companies and the officials of the state and city for their courtesy in entertaining, and the committees for their efforts, were moved by Past President L. B. Marks, and were carried unanimously, when the president declared the convention adjourned.

Besides the interesting features pertaining to the celebration by the city, several special features were provided by the local committee. Tuesday afternoon, the members were given a lunch; and, in the evening, an exhibition of photometers and other interesting apparatus was given, this being conducted by W. D'A. Ryan. In addition to the instruments shown, Mr. Ryan exhibited handsome volumes of photometric curves of different lamps, and of illuminating problems. Wednesday afternoon, an excursion was taken to Nantasket Beach, where a dinner was served. During the afternoon the committee on nomenclature and standards met and discussed important matters.

Canadian Independent Telephone Association.

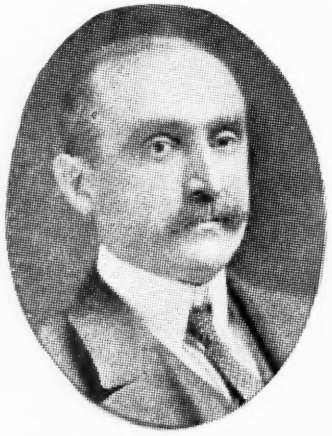
The officers of the Canadian Independent Telephone Association announce their annual meeting for September 4 at Toronto, and extend a cordial invitation to independent telephone men in the United States, particularly to the officers of their sister organizations, to attend and participate. The Canadian convention is being held during the Toronto exhibition, so that low railroad and steamboat rates will be in force from all parts of the United States.

Samuel McClintock Hamill.

After an illness of seven weeks with typhoid fever and pleurisy, Samuel McClintock Hamill, who figured most prominently in the early history of the electrical industry, and who of late years had been connected with the General Electric Company, died at his home in Schenectady, July 29, 1907.

Of late, Mr. Hamill was interested in a number of industrial and financial enterprises which necessitated his attending to so many duties, wearing him out so that when the attack of fever came he could not resist it. He was one of the most whole-souled and genial of men and possessed a host of friends and acquaintances who will deplore his decease.

He is survived by his widow and two small children, Mary B., aged five and Samuel M., Jr., aged fifteen months. In addition to his immediate family a brother, Hugh H. Hamill, of Trenton,



Samuel McClintock Hamill.

N. J., and his sister, Mrs. Edward P. Wood, of Princeton, also survive him.

Mr. Hamill was born in Lawrenceville, N. J., March 27, 1858, and was the son of the Rev. Samuel M. Hamill, D.D., and Matilda Green. He was educated at the Lawrenceville school, of which his father was for fifty years the head. In 1880 he graduated from Princeton University, with the degree of B.A., and three years later received the master's degree. For three years he was a teacher in the Lawrenceville school and for a time studied law.

In 1883 Mr. Hamill accepted a position with the Chicago, Burlington & Quincy Railroad. In 1886 he resigned to become secretary of the Brush Electric Company, of Cleveland, Ohio. He was vice-president and general manager of this company when it was consolidated with the General Electric Company, and at that time moved to Schenectady, where he has since been connected with the General Electric Company.

At the time of his death, Mr. Hamill was president of the Schenectady Trust Company, a trustee of the Ellis Hospital and the Old Ladies' Home; a director of the Young Men's Christian Association and an officer and director in a number of electrical corporations.

He was a member of the Mohawk and the Mohawk Golf clubs of Schenectady; the University and Princeton clubs of New York city; the Ivy, Golf and Nassau clubs of Princeton, N. J.; Country Club of Trenton, N. J., and the Union Club of Cleveland, Ohio.

In November, 1900, he was united in marriage to Miss Maria Woodward Baldwin, of Baltimore, Md.

The funeral services were held in Schenectady, July 30, from the First Presbyterian Church, of which Mr. Hamill was a member. The funeral party left immediately after the services for Lawrenceville, N. J., where interment was had in the Hamill family plot. Among the honorary pall bearers were: President C. A. Coffin, of the General Electric Company; F. P. Fish, of the American Telephone and Telegraph Company, Boston; A. Butler Duncan, New York city; Gerardus Smith, Schenectady; Colonel Robert T. Emmet, New Rochelle; W. L. R. Emmett, W. T. Hanson, Everett Smith, Schenectady; Blair Lee, Washington, D. C.; Pliny Fisk, New York; J. R. Lovejoy, E. W. Rice, Jr., Schenectady; Henry W. Green, Trenton, N. J.; Hon. Myron T. Herrick, ex-governor of Ohio; Robert McA. Lloyd, General Vehicle Company, New York; Rudolph Schrimer, New York.

Electrical Exhibition at Lyons.

An exhibition of apparatus connected with the application of electricity to agriculture and industrial arts will be held at Lyons, France, in May, 1908, by the Société d'Agriculture, Sciences, et Industrie de Lyon. The town of Lyons is in the centre of a region intersected with numerous transmission lines, from which upwards of 200,000-horse-power can be obtained at the present time, and the water-power resources of the surrounding districts are such that enormous extensions could be made to supply the power needs of the large district embraced by the basins of the Loire, the Auvergne, the Western Pyrenees, and Savoy. It is the object of the promoters of the exhibition to further these developments by putting before the agricultural and industrial population the possibilities which are at their disposal by the adoption of electric motive power by means of practical object-lessons.—*Electrical Engineering*, London.

Electrical Notes from Europe.

(By Our Special Correspondent.)

ENGINEER HARLÉ'S report upon the feasibility of erecting a hydraulic plant on the Rhone and running a power line as far as Paris is of interest in many ways. According to the plan which he traces, the idea does not seem impossible. What he proposes is to run a 120,000-volt overhead line on the three-phase system, or else to use the high-tension, direct-current system. The distance measured in a straight line would be in the neighborhood of 260 miles. A large amount of power can be secured from the Rhone, and at the gorges near Genissat, in the Ain, is found a very favorable point for placing the dam, as it can be built solidly between the rock walls and will raise the water to a great height, forming a natural basin. The head of water which can be secured by this plan is reckoned at 200 to 210 feet, with a great volume. From the intake canal, which includes hydraulic work of different kinds, basins, etc., there will be a number of nine-foot penstocks leading to the wheel house. Here are to be placed the main units, using a 9,000-horse-power turbine coupled to a direct-current generator or a three-phase alternator. It is proposed to work the alternators at 12,000 volts and twenty-five cycles, and at first the outfit would comprise twenty-four such groups. Thus the total amount of power used for the station would be about 200,000 horse-power. The engineers base many of their calculations upon the operation of the Niagara plant. Most of the switching apparatus, along with the transformers, would be placed in a special building which is separate from the main station, and would be of large size, at least as regards the three-phase transmission. At Paris there would be a number of substations erected which would give different voltages on the secondary mains. Most of the current would be used for motor work in the city, where there is a good field for the use of cheap current. It could be supplied far below the present price, which is very high, this being due to the high price of coal in France. The present project is drawn up by Engineers Blondel, Harlé and Mähl.

An extensive system of interurban electric lines is to be installed in the North of Italy in the region of Parma. It will comprize two main sections and the total length will be about forty-five miles. The first section will run from Parma to Stradella and Formovo, while the second line joins this section at Stradella and proceeds to the town of Marzolara. According to the reports, it is stated that alternating current at forty-two cycles is to be used on the present system, and a generating plant of some size will be erected by the Milan branch of the Siemens-Schuckert firm, who will equip the cars with the company's motors. The rolling stock at the outset will be made up of ten motor-cars containing first and second-class compartments and equipped with double bogies of two axles each. There will be two sixty-horse-power motors per car. Eight other motor-cars, for second-class passengers only, will have two axles and are to be fitted with one sixty-horse-power motor. A number of trailers will be used with the motor-cars. Freight will be carried as well as passengers.

The question of adopting electric traction upon the government railroads in Switzerland is being very actively taken up at present. Not long since there was appointed a special commission in order to make a thorough investigation of the best method of carrying out an electric system which can be applied to standard gauge railroads, profiting by the most recent experience on the Simplon and other lines. In the present commission there are included the Federal Railroad Department, the St. Gothard Railroad, the Swiss Electrical Society, a number of financial enterprises and the officials of the leading Swiss electrical construction companies and the principal hydraulic plants. Since its formation the commission has been engaged in collecting the necessary data, and a number of sub-commissions are formed, each of which takes up a particular side of the subject. The first sub-commission has been examining the general applicability of electric traction for main lines and smaller railroads and the main results of its investigations were summed up in the very complete report on the subject which Dr. Wyssling made not long since, using the data obtained from engineer Thormann's researches. As to the second sub-commission, it has already made good progress, and its work is nearly completed. This relates to the relation between the technical and the financial side of the question as regards different methods of electric traction. In order to obtain the necessary data, the commission made investigations upon about twenty-five of the leading electric roads in Europe, also a number of the American lines. A special delegation was sent to America for the purpose. All this data will give rise to very complete and lengthy reports on the question. Hydraulic plants and the use of such current is the field occupied by the third commission, while the last two commissions treat of different financial questions.

A test of considerable interest was made not long since in Germany upon a steam turbine-alternator group which was made up of a turbine of the Parsons type built by Brown, Boveri & Company, the well-known Swiss firm, and a three-phase alternator of the same make. The turbine was rated at 4,000 horse-power and operated at 1,500 revolutions per minute, working at eight atmospheres and using a surface condenser. As to the alternator, it was rated at 2,500 kilowatts and gave 3,100 volts at fifty cycles. Current from the alternator was used for a variety of purposes, so that the load was quite variable. For instance, there were four sets of rolls operated by electric motors, a gas-purifying plant, an electric light plant, etc. Accordingly the load on the turbine group varied from 800 to 3,000 kilowatts. But on account of the efficient working of the governor, it was found that between no load and full load on the machine, the variation of speed did not exceed four per cent. The apparatus is arranged so that should a heavy load cause the speed to drop by 0.5 per cent, the action of the governor opens a special valve which lets steam into the high-pressure cylinder. In the present group the steam is not superheated above 328 degrees centigrade, which is found to be sufficient. The steam consumption at different loads is found by weighing the condenser water in the usual way, and the results are as follows: For no load, the steam consumption is 7.61 kilogrammes per kilowatt-hour; at half load it is 6.89 kilogrammes, and at full load, 6.81 kilogrammes. These results show a very good performance for the present group.

A recent German patent granted to A. Bergmann relates to a process for storage batteries of the dry type, in which the electrolyte is a gelatinous mass. The dis-

advantages of the present processes for manufacturing such electrolytes are stated to be as follows: water, glass and sulphuric acid are often used in this case, taking one part of a thirty-three per cent silicate of soda solution and from two to five parts of sulphuric acid at a strength of thirty-three degrees Beaumé, or at a specific gravity of 1.29. By adding the silicate of soda in the proper proportion, the specific gravity of the mixture is regulated at about 1.25. Such an electrolyte gives a mass which has many disadvantages. Under the action of the gas which is given off during the charging of the battery, the mass is affected and loses its homogeneous character. At the same time it is likely to become filled with cracks. Active matter falls from the plates into the cracks and is almost sure to cause a short-circuit within a greater or less time. As the cell thus dries up, it soon becomes worthless. The use of different solid bodies in such mixtures, such as asbestos, glass powder, sand, etc., is found to give very poor results.

According to the inventor's method, he uses a stronger acid, bringing it now to forty to sixty-six degrees Beaumé, instead of thirty-three degrees, with a specific gravity of 1.38 to 1.84. The resulting mixture with water glass gives, instead of a gelatinous mass, a mass which is hard and porous, resembling pumice stone in character. The porous property has a good effect in allowing the gases to pass off readily. He uses, for instance, one part silicate of soda of the above strength and two parts sulphuric acid at 1.53 specific gravity. After well mixing and removing the excess of acid the result is a hard electrolyte, and in it the density of the acid is lowered to 1.45 specific gravity by the amount of water which the water glass solution furnishes. Such a mass is found to give good results in practice.

Blast furnace gas is used to a considerable extent on the Continent for running specially built engines, generally of a large size, and their use is constantly on the increase. An example of such a plant comes from Germany. In this case engines have been installed near the blast furnaces, so that the gas can be transported by piping and used for running the engines at a very low cost. The engine outfit consists of three 100-horse-power gas motors, together with a 200-horse-power steam engine. For the latter, the boilers are heated by gas from the furnaces, or coal can be used. The gas is delivered for the engines at the rate of $0.004 per cubic metre, and the cost of power is thus only $0.016 per kilowatt-hour.

The Siemens-Schuckert Company is to furnish a number of motor cars on the single-phase system for one of the Italian traction roads, the Rome-Civita Castellana interurban tramway line. In the present case the motors are operated at 6,000 volts and twenty-five cycles. The motors are rated at forty horse-power each. However, the high voltage will be used only in the part of the line lying outside the city. In the city limits the current will be reduced to 600 volts.

Paris, July 22. C. L. DURAND.

Long Island Railroad Electrification.

The board of estimate having removed the last obstacle by granting the necessary franchise, the Long Island Railroad has undertaken the construction of the Glendale cut-off between Glendale Junction and Woodside, the latter at the entrance to the Sunnyside yard in Long Island City. The importance of this cut-off lies in the fact that without it the extension of the electrical service to other parts of the Long Island road is impracticable. The new line will consist of four tracks, and will enable the company to separate passenger from freight traffic between the East river tunnels and the main lines to the south and west. Thus, between Glendale Junction and the mouth of the tunnels in Long Island City all passenger traffic will go by way of this new line running through Woodside, whereas all freight traffic between Long Island City and the interior of the island will be handled over the existing line.

The cut-off will also make possible the more direct haul of the traffic from the Rockaway division to the Pennsylvania terminals in Manhattan. The construction of this new line will mean the elimination of all grade crossings on the way from Jamaica to Woodside, and the installation of electric power. At the present time there would be no object in extending the electrification beyond where it now is because of the limited capacity of the line over which the electrified part of the system connects with Long Island City, and the fact that the motive power over these lines is still steam.

The reconstruction and electrification of the line from Jamaica to Woodside will require at least another year to complete. But it is expected that late in 1908, or at the latest early in 1909, electrical trains will be sent into the Pennsylvania terminal.

The lines which are next on the company's programme to be equipped with electrical power are those to Whitestone Landing and Port Washington. The double tracking of the Port Washington branch is proceeding as rapidly as the necessity of condemning right of way in a good many places will allow. This double track will extend as far as Great Neck, between which point and Flushing the work is now under way. Double tracking is also under way on the Oyster Bay branch between Roslyn and Glen Head, but the company has not yet announced when this line will be electrified.

On the main line the electric power is already used as far as Belmont Park, and when the Glendale cut-off has been completed the electric installation will be carried on to Garden City and down around the loop through Hempstead Gardens to Valley Stream. From the latter point back to Jamaica the line is already electrically equipped, so there will be a loop of electrical railroad from Jamaica through Belmont Park, Garden City and Valley Stream back to Jamaica again.

Electrical Work in India.

Consul-General William H. Michael, of Calcutta, submits the following openings in India for electrical engineering:

The city of Poona, forty-five miles from Bombay, at an elevation of 1,800 feet above sea level, is a week-end resort for many of the well-to-do citizens of Bombay, who have fine cottage homes there, or have reserved suites of rooms at the hotels and boarding houses. The latest scheme for improvement at Poona is an extensive electric-car system. A Bombay firm has made a start with a scheme to provide Poona with electric light for streets, power, and cars. The supply, at first, is to be confined to the municipal limits of Poona, and this area enlarged as the demand requires. It is proposed to supply the energy from a central station, and to lay underground mains, or to erect overhead wires, as may be approved by the local government. All the streets to be supplied are under control of the municipal government, but it is already understood that there will be no opposition by government to the proposed scheme.

No country stands as well in India as America in regard to all kinds of electrical machinery and supplies, as well as to methods in the use of them. American electrical engineers are here considered the best in the world, and I would modestly suggest that they pay some attention to the Poona proposition.

The extensive electrical works in Kashmir, under the direction of American electrical engineers are making rapid progress toward completion. The power is derived from the Jhelum river, below Baramulla. The big flume, capable of carrying 20,000-horse-power, is completed, and the turbines to furnish 5,000-horse-power are being installed. Electrical power for mills and other purposes will be conveyed to Serinagur, many miles away.

Boiler, Engine and Generator Testing and Management–IV.

By Charles L. Hubbard.

Points on the Management of Steam Engines and Generators.

ALTHOUGH a properly designed and well made engine requires but little care while running, the engineer in charge must always be on the alert for emergencies and keep a careful lookout for any indication of defective operation.

After an engine is erected and put in proper adjustment, the duty of those in charge is to keep it in this condition so far as possible, so that the principal matters requiring attention are lubrication, adjustment of bearings and suitable care in the way of keeping all parts clean and free from the accumulation of dust and oil.

In the matter of lubrication the first item of importance is the selection of a suitable oil. For cylinder lubrication a heavy mineral oil should be used, as animal oils are decomposed by the heat and form a hard coating upon the internal surfaces of the cylinder and steam chest. For journals and bearings this should be thinned somewhat with a lighter organic oil. There are various high-grade oils upon the market adapted to the different parts of an engine, and also special oils for the high and low-pressure cylinders of compound engines, so that the duty of the engineer is usually confined to the selection of an oil best adapted to the conditions of his own plant. Cylinder lubrication is commonly effected by means of an automatic sight-feed lubricator, in which the oil is made to pass drop by drop through a glass tube filled with water, as it is fed into the steam pipe above the throttle valve. The lubricator should be adjusted to supply only sufficient oil for actual needs, as a surplus is not only a waste but it requires special care in purifying the exhaust steam in case it is used for heating purposes.

The method of supplying oil to the different bearings varies with the make and type of engine.

For slow-speed engines, oil cups are commonly used, but with high-speed it is customary to use some form of forced lubrication, either by means of a small pump, or feeding from an elevated reservoir. The main bearings are often provided with a tallow cup in the cap of the bearing, in addition to the regular oil cup or automatic feed. This is for use in case the oil supply fails for any reason and the bearing becomes heated, as under these conditions the tallow will melt and flow into the bearing as needed. Should it ever become necessary to cool a bearing with water, it must be done very slowly in order to prevent cracking or warping the metal by too sudden contraction.

Every plant of any importance should be provided with means for collecting the oil from the bearings and purifying it for use over again. The impurities are chiefly mechanical, and consist of dust, grit, water and fine particles removed from the rubbing surfaces. In judging of the necessity for purification, or of the efficiency of any process, tests for viscosity, friction, or color may be used, although the latter is most convenient and is reliable in the majority of cases.

The purification of oil may be accomplished by settling, by percolation, by capillary action, by agitation, or by a combination of two or more of these.

Devices for the purification are usually called "filters," whatever the principle upon which they operate.

In the case of settling, the oil is placed in tanks of considerable depth and large volume relative to the amount of oil in actual use,

The impurities settle to the bottom, some at once, and others more slowly, and the upper portion of the tank will, after a time, be found to contain relatively clear oil which can be drawn off for use.

Almost complete removal of mechanical impurities can be accomplished in this way, if sufficient time is allowed and care taken in adding dirty oil and withdrawing the clear oil, not to disturb the contents of the tank.

Purification by percolation is accomplished by passing the oil through suitable filtering material supported upon wire gauze or perforated metal. The materials commonly used for this purpose are waste, hair felt, cheese-cloth, charcoal, shavings, sponge, and many other substances of a similar nature.

Blotting paper supported upon a proper screen has been found to give very satisfactory results.

Capillary filters are those in which the oil is separated from its impurities by the capillary action of a wick of cotton or other material. This form has certain advantages, among which are the following:

It is impossible to rush the operation; the destruction of the wick does not result in a deluge of dirty oil into the clean oil reservoir, and the wick will stand longer usage without cleaning or renewal than will the filtering medium in the percolating process.

Purification by agitation consists in forcing the dirty oil through a body of water, or in mixing the oil and water by shaking, and then allowing the mixture to settle, after which the oil can be drawn off from the top of the tank.

Various devices upon the market employ all of these methods, usually two or more in combination. The results in any case usually depend to a large extent upon the care and attention bestowed upon the apparatus rather than upon the particular method employed.

By the repeated use of oil it will be found possible to materially reduce the oil bill of the plant and also to buy oil of a better quality than can be afforded where no attempt is made to reclaim it.

At the present time there is no satisfactory way of saving the cylinder oil, and the selection of an oil for this purpose should be governed by two things: First, it should be of such high viscosity as to do the lubricating with a minimum number of drops per minute, fed through the lubricator, and at the same time it should be free from acid and from animal or vegetable ingredients.

The adjustment of the various bearings of an engine is a matter of much importance, and requires constant attention upon the part of the attendant. Horizontal engines should be watched for signs of wear upon the lower part of the cylinder, due to the weight of the piston. The piston rings require careful adjustment in order to avoid cutting the cylinder walls, and the piston rod must be kept exactly centered to prevent excessive wear in the stuffing box and also to prevent springing the rod itself. Stuffing boxes must be well packed and adjusted, and the packing should be renewed as often as necessary to keep a tight and smoothly working joint.

The connecting-rod bearings at both the crank and wrist-pins should receive careful attention, as the "knocking" so often heard in engines is generally caused by

a slight wearing of the brasses at these points. The main bearings should be examined frequently, and any lateral movement taken up by proper adjustment of the side boxes, and in the case of high-speed engines the caps should be tightened occasionally to prevent any upward movement of the shaft.

Among the things which may affect the amount of steam used by the engine, is the tightness of the valves and piston. At some convenient time these should be tested for leakage as follows: Trip the admission valves in order to close them; open the throttle and the indicator cocks at each end; escape of steam through either or both cocks indicates corresponding leakage of the admission valves. The extent of the leakage can be judged by the volume and force of the escaping steam. Serious leakage should be corrected by reboring the valve seats and refitting the valves, or putting in new ones.

To test the exhaust valves for leakage, remove the back bonnets from all of the valves. Place the wrist-plate in mid-position and adjust the lengths of the admission valve rods to hold the head-end valve open a small distance and the crank-end valve closed, and the lengths of the exhaust valve rods to hold the head-end valve closed by a large amount and the crank-end valve open.

Before making these changes carefully note the original adjustments, so that the valve motion can be restored with certainty to its proper running conditions. Replace the bonnets at the head end and open the throttle. Steam escaping from the crank-end exhaust port indicates leakage of the head-end exhaust valve. Adjust the valves for a similar test of the crank-end exhaust valve and note the result.

Serious leakage can be remedied as in case of the admission valves.

To test the piston for leakage, block the engine flywheel so that the crank is at about quarter-stroke from the head end; open the throttle and the indicator cock at the crank end of the cylinder. The escape of steam indicates leakage of the piston. This should be tried in other positions of the crank as well.

Serious leakage indicates improper conditions or adjustment of the piston rings or a worn cylinder. Examination should be made and the cylinder rebored or the rings renewed or adjusted as required.

The above applies to an engine having valves of the Corliss type. For other makes and type of valve the general principles remain the same, but the procedure must be varied to suit the design and action of the valve or valves.

In the case of a simple slide-valve engine, set the valve in its central position and open the throttle and indicator cocks; any leakage will be denoted as already described.

The method of starting up an engine is, of course, familiar to all who have had any experience whatever in the care of steam apparatus, but for the benefit of the beginner it may not be out of place to devote a small amount of space to this important matter.

Before starting up an engine the condition of the boiler should be noted to see that steam is up and the water-line at its normal position. All tools and loose parts must be removed from the engine, oil cups and cylinder lubricator filled and adjusted, and the drain cocks opened. The throttle valve may now be opened sufficiently to allow a small quantity of steam to blow through to warm up the cylinder and adjacent parts and to clear them of condensation. In engines of large size it is customary to work the valve by hand for a few revolutions until it is seen that everything is in working order. Those of smaller size may be slowly brought up to speed by means of the throttle valve alone.

The drip cocks should remain open until all water is expelled from the cylinder. An engine should be started slowly, not only as a precaution against accidents to itself, but also to avoid priming at the boilers, which is likely to occur if a sudden rush of steam is produced through the nozzles. When a condenser is used it should be started first, and stopped only after the engine has been shut down. In the case of a surface condenser, first start the air-pump, and when a sufficient vacuum has been formed start the circulating pump and then the engine as already described. If the condenser has a combination air and circulating pump, they must, of course, be started at the same time.

The grease which accumulates upon the tubes of a surface condenser should be removed occasionally by the use of a strong solution of soda. If a jet condenser is used, first start the pump, then partially open the injection valve and run the pump rapidly until the condensing water comes. Then speed the pump so that it will be just ahead of the water and the water valves can be heard to close with force. This will insure a proper emptying of the condenser and cause the highest vacuum to be formed. The engine may now be started as before. Priming usually makes its presence known by a "slapping" sound in the cylinder, which is produced by the piston striking the water and throwing it against the cylinder heads. As soon as this sound is heard, the cylinder drains should be opened and a hurried inspection made of the separator to see if it is working properly. If there is considerable water in the glass on the separator, the by-pass around the trap which drains it should be opened wide. When these precautions have been taken in the engine room, the engineer should visit the boilers and order the firemen to cover the fires of the priming boiler with fresh fuel.

Meanwhile, the water-level in the gauge glasses should be noted and if any of them show high water, the blow-off should be opened and the water brought down to its proper level.

These precautions will, in nearly every case stop the priming, but if they do not, the stop-valve on the offending boiler should be partially closed so as to wire-draw the steam and thus dry it. The engineer should always have a general oversight of the boilers, and before shutting down the engine he should notify the firemen so the fires may be allowed to burn down somewhat before this is done.

The care and operation of electric generators is taken up in detail in a number of well-written books upon the subject, and the engineer is advised to provide himself with one or more of these for careful study. However, a few important points may perhaps be touched upon in this article without prolonging it too much.

One of the first points to be considered in connection with the care of a dynamo is cleanliness, and better results can be obtained if this is done immediately after shutting down than if allowed to stand for some time, as the oil and grit are more easily removed when warm. An air-blast supplied through a flexible hose is one of the best means of reaching the more inaccessible parts of a machine, and the necessary apparatus, which consists of a small motor-driven pump which may be portable if desired.

It is a good idea in the case of small and medium-sized machines to provide a canvas cover for placing over them after cleaning in order to prevent the dust from settling upon them again.

Before starting up a machine, a careful examination should be made to see that all of the connections are right, and also to make sure that no tools have been left lying about. Note if the brushes are all set and have the proper tension. It

is often customary to bring dynamos to their full speed before lowering the brushes into contact with the commutator. This is unnecessary unless there is danger of the machine being turned backwards, which would damage copper brushes.

The main switch connecting a dynamo into the circuit should not be thrown in until the dynamo is "built up," that is, operating at the required voltage indicated by a voltmeter or pilot lamp. This does not apply, however, when operating on an independent circuit, for it then does no harm to have the circuit on and allow it to build up with the machine.

A heavy load should never be thrown upon a generator suddenly when it is possible to avoid it; instead, the load should be gradually increased by means of circuit switches, or if connected in multiple with other machines, the shifting should be done by degrees.

Machines which are new and being operated for the first time require special attention, and it is well, when possible, to run them for a short time at less than full load. Probably overloading causes as much trouble as any one thing, and should therefore be guarded against as much as possible. Iron and steel tools which are subject to the action of magnetism should be kept away from a dynamo when running to prevent their being drawn in among the moving parts. Copper or brass oil cans should be used for the same reason.

If it is desired to stop a generator operating in parallel with others, gradually remove the load until its ammeter indicates little or no current, then open the switch. Under no circumstances should the speed be lowered or the magnetism weakened before disconnecting.

If this were done, the machine would probably run as a motor, taking its current from the main circuit, which might cause serious damage. If a machine is operating alone on a circuit, gradually decrease the speed and allow it to stop without touching either the brushes or switches. Do not switch out a dynamo at full or partial load, except in case of emergency.

Never lift a brush while a dynamo is generating current except when there are other brushes in contact upon the same side. The cause of sparking at the brushes varies in different types of machines. Some of the more common reasons for this difficulty in direct-current multiple machines are as follows: Brushes not set at the neutral point, current overload, rough commutator, open coil in armature, short-circuited coil, leak from coil to frame, weak or uneven magnetism, poor brushes or excessive vibration of the machine.

When sparking is caused by an improper position of the brushes, it is easily remedied by shifting them either backward or forward until the neutral point is found. This will be evident from the action of the machine. An overload will produce sparking, as probably the capacity of the commutator and brushes may not be sufficient, and in this case there is no remedy except to reduce the load.

It is not difficult to keep a commutator which has no original defects in good condition if properly cared for from the start; but if allowed to get rough and full of ridges it takes considerable time and care to bring it into proper shape again.

An open coil can be detected by a spark which will appear to travel almost around the commutator. The defective coil can sometimes be found by noticing which bar is most damaged by the spark. If there is not time to repair it, the dynamo may be operated for a short time without damage by connecting the two bars together between which the open coil exists. A break usually occurs where the wire is joined to the commutator bar, and is therefore easily located and repaired. A short-circuited coil may be detected by holding a piece of iron between the pole-pieces and in such a way that it will be influenced by the magnetism. The fact that a defective coil exists will be shown by a sudden variation in the pull at a given point in each revolution. A short-circuited coil will heat much more than the others and is very likely to burn out.

A leak from the windings to the frame is generally found by means of a magneto bell. Weak or uneven magnetism will cause sparking at the brushes and also reduce the electromotive force when running at the normal speed.

The brushes should be kept properly fitted and no ragged edges be allowed to form. They should be set on the commutator in such a way that the intended contact surface shall be in contact at all times.

Excessive heat exists if the armature or field coils become so hot that the hand can not be kept upon them for a short time without discomfort.

The Open-Tank Method for the Treatment of Timber.

A marked saving in three directions—cost of equipment, of materials and labor, and of transportation—is being effected by the introduction of what is known as the "open-tank" method of treating timber. The general practice of preserving timber has hitherto been retarded by the heavy cost of closed retorts and other complicated equipment ordinarily used and the need of experienced men to operate them. Not until the kinds of timber long used and considered almost indispensable for certain purposes grew scarce and rose alarmingly in price did wood users consider seriously the possibility of consuming less wood by making it last longer.

As a rule, preserving plants have been located at lumber centers, where a large business might be expected, and it has often been necessary to pay transportation charges to and from the treating plant on timber needed for local uses, such as for ties, posts and poles. The equipment of the open-tank method, which consists of an open tank, capable of withstanding heat, and either equipped with steam coils or so arranged that fire can be placed underneath, is so simple and comparatively so cheap that it is within reach of the smaller companies, contractors and farmers. The fact that it is portable gives it a distinctive value, since it can be taken, if necessary, into the heart of the forest, and even into the mountains.

One of the chief advantages of the open-tank process is that it can be effectively applied to parts of timbers which are especially subject to rapid decay, such as the butts of fence posts and telephone poles, without wasting preservatives on other parts. It is also especially adapted to the treatment of mine props, small-dimension timbers, cross-ties, piling and shingles, and timbers in small sizes of loblolly pine, black and tupelo gum, western yellow pine, and lodgepole pine, and similar kinds of wood. Fairly good results have been obtained in the treatment of arborvitæ, chestnut and red oak, but the experiments thus far do not warrant the application of the method to the treatment of piling and ties made of these woods.

The open-tank treatment is being rapidly developed, and while it ordinarily does not secure so deep a penetration of the chemicals as the retorts, it is sufficiently thorough to protect timber for practical purposes in many situations, and it is probable that future experiments will further extend its application.

Circular 101, just issued by the Forest Service, United States Department of Agriculture, describes and illustrates the open-tank equipment. It can be had upon application to the Forester, United States Department of Agriculture.

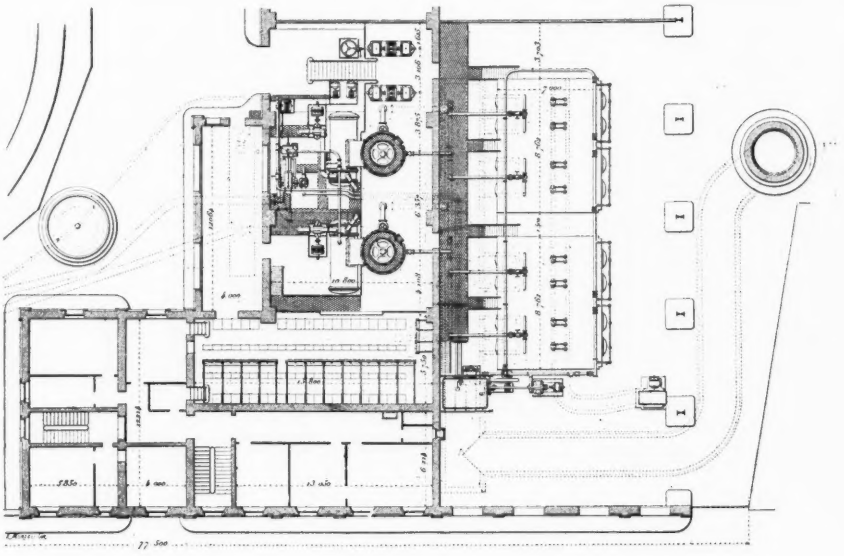
The Central Station of the Société du Gaz et de l'Electricité, of Nice, France.

By C. L. Durand.

A STEAM-TURBINE plant of considerable size has been installed within a recent period in the city of Nice, France, in order to furnish a supply of current which was needed for some time past, owing to the increase in the electric lighting especially, and also in the use of motors. The present station was erected by the Gas and Electric Company of Nice, and is of interest as being the first electric plant in France to use the Curtis type of steam turbines. In the Nice plant there are two large turbine-alternator groups installed, these having been built in the Paris factories of the Compagnie Française Thomson-Houston, and they are now running very successfully. Since the present station was erected, other steam-turbine plants have been either completed or are now in course of construction in France, and it will not be long before there will be a number of stations throughout the country which are using Curtis turbines. Among these may be mentioned the new station which has recently been completed at Marseilles for the City Gas Company, and of which we hope to give a description in the near future; also the plants installed in the towns of Arles and Tuilière, and the stations to be erected for the Rhone Power Company, the Tramway Companies of Nancy and of Rheims, the Bethune Mine Company, and others. One of the most important is the new plant belonging to the Lyons Tramway Company, in which two steam-turbine groups are to be installed. It is to be noted that as regards the present station at Nice, the company has already ordered a third turbine group of somewhat higher capacity than the two preceding sets, and it will shortly be installed.

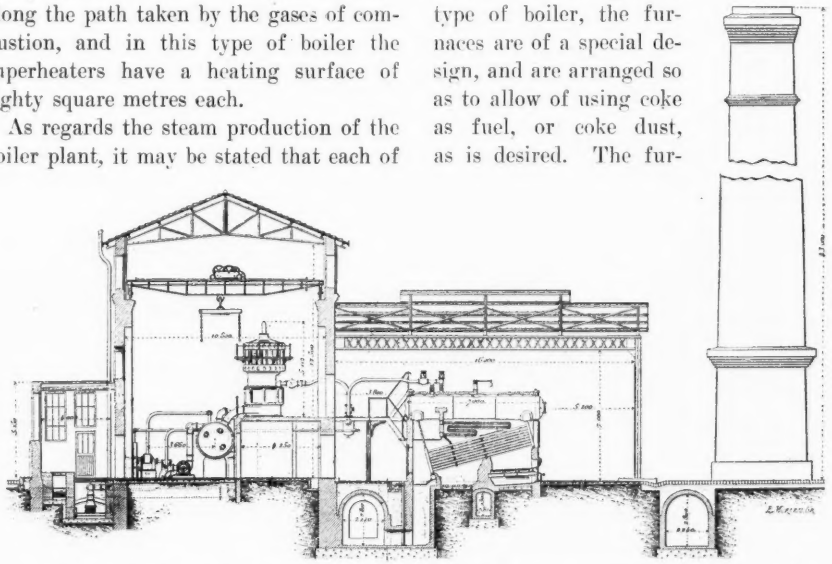
The Nice station includes a boiler house and a dynamo room containing two Curtis turbine-alternator sets of 800 kilowatts each, delivering three-phase current at 10,000 volts and twenty-five cycles, besides the necessary switchboard apparatus.

The boiler room is well laid out, and a view of the boilers is shown in one of the accompanying engravings. At present there are installed four boilers of the multitubular type which are designed so that they can be rapidly brought up to pressure. At the same time they are fitted with a water reservoir which is sufficient to assure the proper stability of working. The boilers are gauged at thirteen atmospheres pressure and have a total heating surface of 300 square metres and a grate surface of 6.80 square metres. They are provided with steam superheaters, which are placed in the most efficient manner along the path taken by the gases of combustion, and in this type of boiler the superheaters have a heating surface of eighty square metres each.



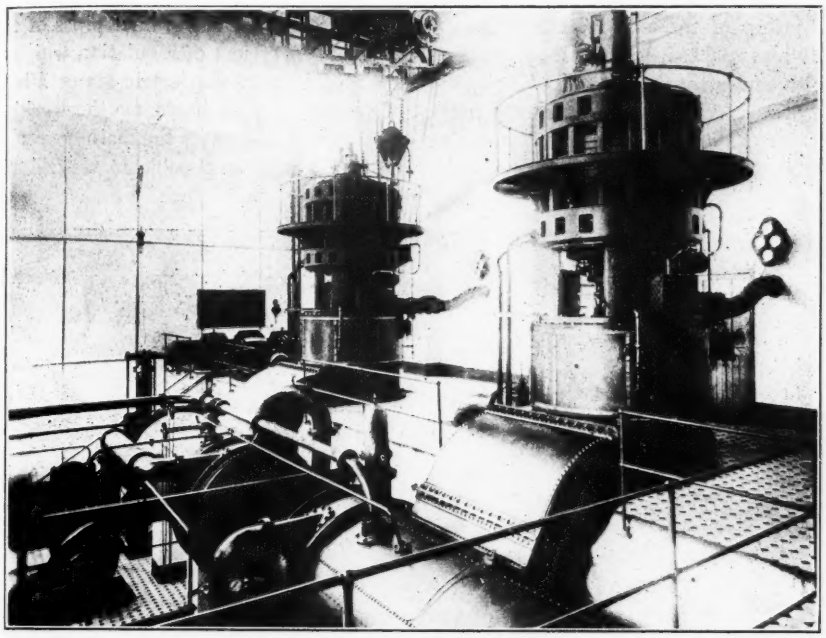
PLAN OF THE CENTRAL STATION OF THE SOCIÉTÉ DU GAZ ET DE L'ELECTRICITÉ, OF NICE, FRANCE.

As regards the steam production of the boiler plant, it may be stated that each of the boilers will produce, under the usual conditions of working, 4,000 kilogrammes (8,820 pounds) of steam at a pressure of twelve atmospheres, the steam in this case being superheated to 125 degrees centigrade above the temperature which corresponds to saturation of the steam at twelve atmospheres pressure. By working the furnace at a higher heat, the steam production can be raised without difficulty to 4,800 kilogrammes (10,600 pounds) per hour. In the present type of boiler, the furnaces are of a special design, and are arranged so as to allow of using coke as fuel, or coke dust, as is desired. The furnaces are accordingly built of plates of cast iron, which are strengthened at the lower part by a series of webs. They are pierced with a set of openings placed according to a regular design, and the upper

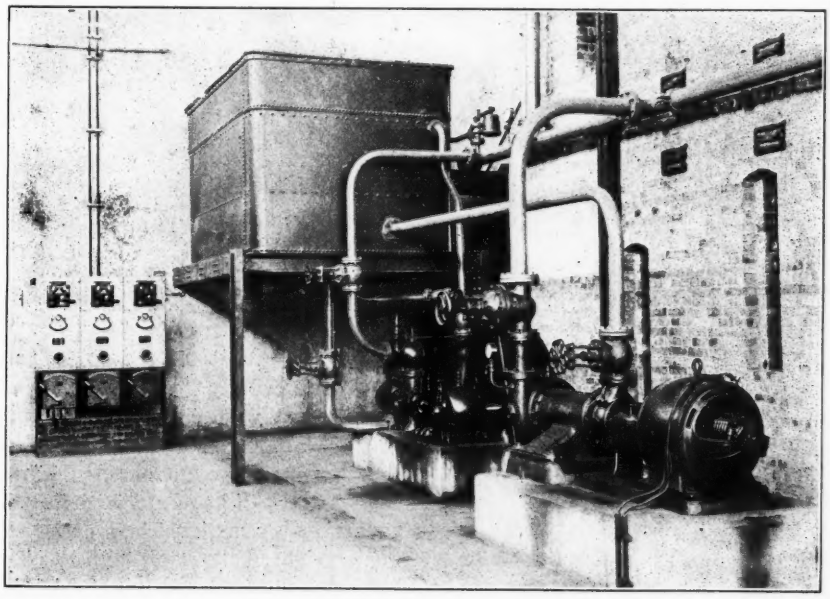


ELEVATION OF THE CENTRAL STATION OF THE SOCIÉTÉ DU GAZ ET DE L'ELECTRICITÉ, NICE, FRANCE.

part of the opening in each case forms a flange which projects about one inch above the upper surface of the plate. By means of a motor-driven air fan placed at one end of the boiler room, air is sent into the furnace below the grate. The air is taken from the fan by a common conduit of large diameter, which is placed below the series of boilers, and from this conduit it is distributed to each of the boilers by conduits placed in the masonry at each side of the ash-pit. Such conduits are arranged so that they can be opened or closed by means of a special register, and the latter can be regulated as desired by a lever placed within easy reach of the attendant. It is to be noted that the above-mentioned opening in the furnace plates are made to serve instead of the usual air spaces, in order to allow the necessary quantity of air to pass into the coke for producing combustion. This arrangement of furnace has been found to work very well for coke consumption.



MAIN TURBINE-GENERATOR GROUPS, CENTRAL STATION OF THE SOCIÉTÉ DU GAZ ET DE L'ELECTRICITÉ, NICE, FRANCE.



PUMPS, CENTRAL STATION OF THE SOCIÉTÉ DU GAZ ET DE L'ELECTRICITÉ, NICE, FRANCE.

The furnaces are provided with a device which gives an injection of water by an atomizer, so that the water enters under the grates, and this is done in order to cool off the furnace in a quick and an efficient manner. In this case the necessary water is distributed, for each of the boilers, by a set of six atomizing nozzles which are placed above the doors of the ash-pits. Each of the nozzles will supply sixty litres (sixteen gallons) of water per hour, working under a pressure of eight or ten metres. The doors of the ash-pits are arranged so as to be closed hermetically when a forced draft is used for the furnaces, and on the other hand to allow the proper amount of air to enter under the furnace grates when the ordinary draft is employed. The furnace gates are closed automatically, and at the upper part of the masonry of the boiler there are placed expansion gates which allow the steam to come off in case one of the boiler tubes should be broken.

As regards the smoke conduits, each of these is led from the boiler into a main conduit of large size running across the boiler house. It is laid out in the present case so as to allow the use of an economizer later on, and it ends in a smoke-stack outside the boiler house which is forty-three metres high and 2.8 metres diameter at the top.

One of the illustrations shows a view in one end of the boiler room, where are placed the boiler-feed pumps. Each of the pumps is driven by an electric motor which is direct-coupled on its shaft, and will deliver at the normal speed about 15,000 litres of water (4,000 gallons) per hour. The pump which is seen in the foreground of the engraving is a centrifugal pump of the turbine type, using a direct-current motor coupled on its shaft which drives it at 1,500 revolutions per minute. The second pump, in the rear, is of the ordinary piston type and uses a smaller direct-current motor. The water which is used for the boiler feed is the water of condensation coming from the main turbines of the dynamo room. Owing to the use of steam turbines, the steam does not contain lubricating oil, and when condensed in the surface condensers it answers very well for the boiler feed. A tank which is placed outside of the station is used as a reserve supply for the feed, and it furnishes only the amount of water which is needed to make up for the losses due to leaks or evaporation.

The elevation and plan views of the station show the general arrangement of the boiler house as just described, and also of the adjoining dynamo room. In the elevation is shown a section through the boiler, in which some of the principal details will be observed, including the ar-

rangement of the principal smoke conduit and the branches which pass to each of the boilers.

In the main dynamo room, of which one of the views shows the general arrangement, there are installed the two principal turbine-alternator groups of the station. Each of these units is formed of an 800-kilowatt turbine, direct-coupled on a vertical shaft to an alternator of the Thomson-Houston three-phase type which works at the standard voltage of 10,000 volts and at twenty-five cycles. The turbines are of the Curtis type such as is usually employed in American plants, as regards the general construction. The present wheels are among the first to be built in the new factory which the company has lately erected at Paris in connection with the already existing plant for the manufacture of dynamos and motors.

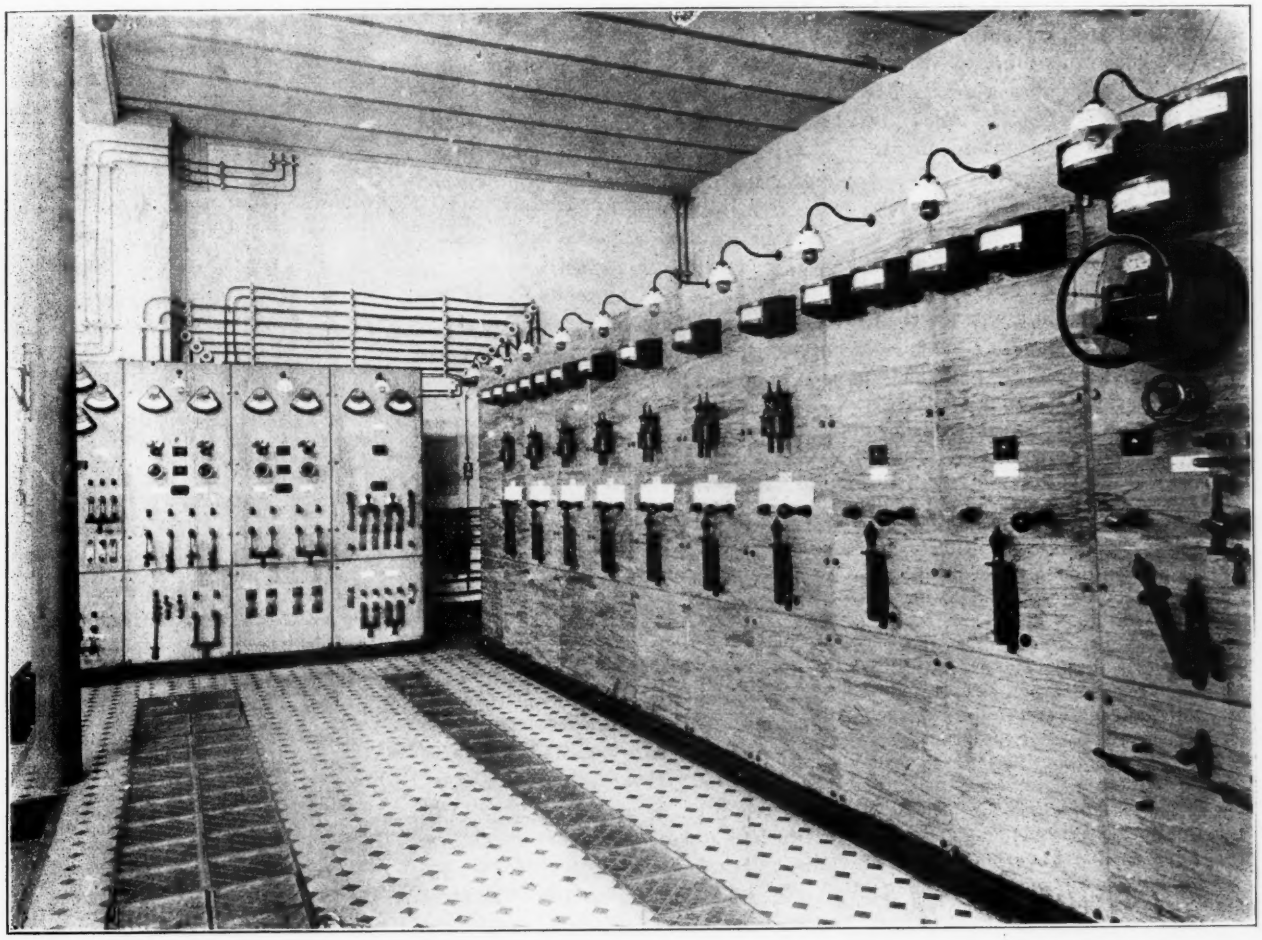
Tests which were made upon the present Curtis turbine groups show that when working at the standard speed of 1,500 revolutions per minute for six hours consecutive running, carrying the full load of 800 kilowatts, the temperature of the high-tension windings of the alternators did not rise above thirty-five degrees centigrade above air. For a two hours' run, the output of the machine can be raised as high as 1,000 kilowatts without any difficulty, and after the run at this load, the rise of temperature does not exceed fifty-five degrees centigrade. The tests also showed that each group was able to support for twenty minutes a momentary overload of fifty per cent, which corresponds to an output of 1,200 kilowatts for the alternators. The present groups are designed to work in exceptional cases under a free exhaust, and in this case each of them will give a maximum output of 600 kilowatts.

The high-tension winding of the alternators is designed so as to stand a test when cold of 20,000 volts applied for five minutes between the armature and the iron, and a test of 15,000 volts applied in the same way when the machine has arrived at the usual working temperature. Regulation of the turbines is carried out by a centrifugal governor, which acts by means of a controller upon a set of electromagnets. The latter are used for opening or closing the steam inlet pipes of the turbines. A system of regulation which is operated by a small electric motor allows of varying to a slight degree the working speed which is kept by the main governor. In this way it is possible to control the speed of the two alternators from the switchboard, so as to obtain the synchronism of the two groups. At the lower end of the turbine shaft is placed the main step-bearing, which supports the whole weight of the revolving part. This bearing is provided with a water lubrication in the usual way. The main shaft of the machine is held in a vertical position by two guide bearings, one of these being placed in the middle part and the other at the upper part. Oil is used in this case for the lubrication. Small

THE BOILER ROOM OF THE SOCIÉTÉ DU GAZ ET DE L'ELECTRICITÉ, NICE, FRANCE.

pumps of a special type operated by electric motors are used for the distribution of the water and oil which are needed for lubricating these three bearings. The main steam inlet pipe of each turbine is provided with a gate which can be closed suddenly by means of a safety device, and the latter is designed to come into use in case of racing of the turbines. It is operated from the shaft of the wheel.

As will be noticed, the two turbine groups are mounted upon a raised platform running along one side of the dynamo room and lying next the boiler house. In front of the turbines and erected upon the level of the main floor are the condensers and pumps. Each of the turbines is provided with a tubular condenser having a horizontal counter-current, with a working cooling surface of 320 square metres, using a set of brass tubes. Each of the condensers receives its water supply from a motor-driven turbine pump placed in front of it. These pumps have a capacity of 465 cubic metres per hour and are driven by direct coupling with a three-phase motor of forty-five horse-power working at 750 revolutions per minute. This part of the plant is completed by a pump for the air supply and a pump for taking off the condensed water. There is a single water pump for the two condensers. The arrangement of the condensers and pumps is best shown in the plan view. As regards the pump which supplies dry air to the condensers, it is of the horizontal type, with slide valve, with piston diameter 550 millimetres, stroke 450 millimetres, and working at 105 revolutions per minute. It is belt-driven from a three-phase motor which operates at 750 revolutions per minute, having a fly-wheel pulley of sufficient weight to give a regular running. The cylinder of the present air-pump is cooled by a water jacket. As to the pump for taking off the condensed water, it is of the vertical type and is operated by a crank from the air-pump just mentioned. It has a piston diameter of 250 millimetres, stroke 120 millimetres, and works at 105 revolutions per minute. This pump sends the condensed water directly into the tank which is used for the boiler feed. The piping of the different apparatus for the water condensation is arranged so as to allow of running the plant with one condenser for each of the turbines, or in other cases with the two condensers connected together, each of the turbine pumps being allotted to the service of a single condenser. A special cooling apparatus is used to cool the water which is sent into the condensers, before being taken by the above-mentioned pumps. The *ensemble* of the condensing and cooling apparatus is designed so as to obtain a good vacuum when the two turbines are operated at full load, and in this case the vacuum in the condenser is at least ninety per cent, provided the outer temperature does not exceed twenty-five degrees centigrade.



SWITCHBOARD OF THE CENTRAL STATION OF THE SOCIÉTÉ DU GAZ ET DE L'ELECTRICITÉ, NICE, FRANCE.

In the rear of the principal turbines will be noticed two small direct-coupled groups, which are used for the exciter circuit of the alternators. These machines also serve to give direct-current for

the station circuits. Each of the two groups is made up of a 100-horse-power three-phase motor, working at 750 revolutions per minute and connected to two generators, one on each end of the shaft. These latter machines are designed to give direct current at 125 volts, and they have a capacity of forty kilowatts each. There are three single-phase transformers, which are coupled together upon the three-phase circuits so as to give a supply of current for the station lines, especially for running the different three-phase motors of the plant. Of the oil-cooled type, these transformers have a capacity of fifty-five kilowatts each, and lower the machine voltage of 10,000 volts to 220 volts. In the station is also installed a storage battery consisting of sixty cells, which give 300 ampere-hours at a three-hour discharge rate.

The switchboard of the station is placed at one end of the dynamo room, with the marble panels situated on the same level as the turbines upon an elevated gallery. Below the panels and in a separate chamber are lodged the different switches, both of the oil and the ordinary type, and in general all the high-tension apparatus. A view of the switchboard panels is shown in one of the engravings. The different panels are laid out as follows: one panel for the two exciters, one panel for the two generators used for the station circuits, a panel for the storage battery, two alternator panels for the main groups and one panel for the lighting and motor circuits of the station. There are, besides, three panels which are used as the terminal point of a three-phase overhead line entering the station, which is operated at 10,000 volts, and also two coupling panels for connecting the bars of the present station with the overhead lines which come to Nice from the neighboring hydraulic plants of the region, which are controlled by the Energie Electrique Company. Besides the above, there are also eight panels for the outgoing feeders of the station. A set of sectionalizing switches is installed so as to be able to connect each of the high-tension panels with one or the other set of 10,000-volt bus-bars. The high-tension oil switches, excepting those which are used for the alternators, are designed for an automatic release by means of a slow-working relay, and these switches are all operated from a distance. They are lodged in masonry recesses for greater safety.

A Westinghouse Appreciation.

George Westinghouse, president of the Westinghouse Electric and Manufacturing Company, in a letter to the stockholders, pays high tribute to the efficiency of the officers and managers of the company. He refers particularly to the work of Vice-President E. M. Herr, Second Vice-President L. A. Osborne, Engineers Charles F. Scott, B. G. Lamme, N. W. Storer, H. P. Davis; Treasurer T. W. Siemon; General Auditor J. C. Bennett, and Purchasing Agent W. J. Longmore. Mr. Westinghouse also says, in part:

"In the annual report the affairs of your company are dealt with at length. From the favorable comments already made by the press throughout the country and by many stockholders, your managers trust they have met the expectations of all of those who are interested in any manner in the continued prosperity of the company.

"In its infancy your business occupied a space having less than 100 square feet of surface. To-day it is carried on in the most complete workshops ever constructed, having a floor area of over seventy-five acres and employing 23,000 operatives.

"Twenty years ago, when your business started, there were no managers, officers or engineers familiar with the class of business, which was then wholly unknown, and these had to be developed. The managers, officers and engineers now in your employ would make a full regiment of active, earnest, skilful soldiers, possessed of technical and business knowledge of the highest order, fully competent to carry forward a business which has really only begun.

"The Westinghouse Electric and Manufacturing Company relief department has a present membership of about 3,400. Medical attention is given each day to from seventy-five to 100, covering sickness, accident cases and redressings of prior injuries. About thirty per cent of those reporting as sick are found to be entitled to benefits. Present sick and accident benefits aggregate $1,000 per month, while the income from premiums is about $2,500 per month.

"During the past ten years your company has had, besides customers, thousands of visitors from all parts of the world, many of whom have been sent by foreign governments to study with care the extensive developments which have resulted in the manufacture of electrical and mechanical apparatus on so extensive a scale. The letters and commendations of these visitors have been most gratifying, especially because of the very frequent references to the superior character of your employés and the facilities provided for them, with the consequent result that your product has always been spoken of in the very highest terms.

"It has been frequently said by those who have studied the business of the various Westinghouse companies that their general cooperation for a common benefit could be made a power of the very highest importance. During the past few years there has been developed a spirit of cooperation which has resulted in greatly spreading the influence of these organizations. This can be made still more effective by each shareholder in the several companies also taking an active interest in this important work."

Extension of Chilean Telegraph System.

United States Consul A. A. Winslow, of Valparaiso, reports that the state telegraph lines of Chile showed a fine increase of business during 1906 over 1905, the messages sent having been 1,962,285 and 1,505,483, respectively, other details being as follows:

The receipts were about $274,617 (United States gold) for 1905 and $367,793 for 1906, a gain of $93,176. The average cost of a telegram was about nineteen cents (United States gold). The government made a liberal appropriation for the betterment of the service for 1907. The service gives very good satisfaction. There are but few private lines in the country. The International Telegraph Line between Chile and Argentina showed a gain of $18,502 over 1905. A new cable is being put in over the Andes, three to four feet deep in the ground, to protect the line from the severe storms and snowslides. Practically all the telegraph and telephone supplies are imported, even to the poles, a large number of which are iron.

Electrical Supply Dealers' Meeting.

The annual meeting of the electrical supply dealers was held at the Hotel Clifton, Niagara Falls, Ontario, on July 23, 24 and 25. Several hundred persons were present and many important manufacturing interests were represented.

The sessions were all executive meetings. On the evening of the 23d a vaudeville performance and concert was given by electrical talent and on the following day the annual baseball game was played between the manufacturers and supply dealers—which resulted in a victory for the manufacturers. The convention terminated with a banquet on the evening of the 26th.

Electrical Notes from Great Britain.

(From Our Special Correspondent.)

SINCE the mailing of my last monthly notes the convention of the Municipal Electrical Association has been held at Sheffield. From criticisms that one hears from year to year, and they are offered again regarding the 1907 meeting, the convention is more profitable for the opportunity that it affords municipal electrical engineers, committee chairmen, some consulting engineers and a few contractors' representatives to fraternize together, than from the paper and discussion point of view. To American readers who have long been used to brief practical topical papers or talks it is unnecessary to point out the unwisdom of having long papers on such occasions. The general consensus of opinion seems to be that the presidential address of S. E. Fedden, the city electrical engineer, was well above the average. He touched upon points which are of direct personal interest to other municipal electrical engineers, while they also should greatly concern the chairmen of their electrical committees, who in many cases meet with them at these conventions. The status of the chief electrical engineer, and the treatment received by him at the hands of committeemen and councillors, are matters of great importance in England. We could fill a book telling of the difficulties put in the way of engineers, and of most unjustifiable interference with them in the performance of their duties by non-technical councillors, but there is so notable a change coming over things of this kind during the last few years that perhaps it is needless here to enlarge upon the theme. It must be added, however, that the whole story would have to include a number of cases where the relations between engineer and councillors have been practically continuously harmonious. Mr. Fedden appears himself to be one of these happy examples. The desirability of continuity in the appointments of engineer and committee chairmen was emphasized in the address, and it is certain that the best results are secured where that sort of thing obtains. Concerning electricity supply management, Mr. Fedden does not agree as a general rule with the division into engineering and commercial departments. He advocates one chief control, for he does not think that men combining the two qualities of commercial development ability and adequate engineering knowledge are so rare as is sometimes suggested. The fact remains, however, that English municipal authorities have only just begun—save in one or two exceptional cases—to develop their undertakings with anything like a spirit of commercial enterprise. In regard to the creation of a demand Mr. Fedden is no believer in the teaching of the "exponents of the new publicity who are arising among us each with his own particular method for stunning the unsuspecting public." He wants this enterprise kept free from the taint of mere huckstering, and advocates as the safest and most efficient means demonstrations in the form of press records of work done, showroom displays, exhibitions, and the loan of apparatus on approval.

The subject of "Extensions of Electricity Supply to Outlying Districts" was introduced by R. L. Acland, who showed his own way of dealing with it at Chesterfield, using the tramway feeders, with a Tirrill regulator, to provide automatic regulation in the substation on account of the wide variation in voltage on the traction feeders. Speakers who followed related their own satisfactory experiences with the Tirrill regulator. "Cheap Power Supply by Municipalities," by C. E. C. Shawfield, urged the necessity for adjusting tariffs to suit competition, leaving the cost of production to adjust itself to the tariff. H. R. Burnett dealt with "The Costs of Electricity Supply and Their Relation to Scales of Charges," saying that the methods of charging in many cases were unnecessarily complicated and numerous, and the charges did not bear that relation to the costs of production that one might reasonably expect. The reason of this was that many engineers, in his opinion, did not accurately ascertain the costs of supply from their works, or if they did didn't give the information the consideration it deserved in fixing scales. He suggested a basis upon which revision should take place in order to obtain greater uniformity in tariffs. These two cost papers were discussed together. C. H. Yeaman brought up once again the question of "Depreciation and Reserves for Antiquation and Obsolescence, from an Engineering Standpoint;" Robert McCourt read a paper on the value of photometry in central station practice, and A. J. Cridge contributed some notes on alternating-current distribution.

The British Electric Traction Company, which for the last ten years has been promoting and operating electric tramway systems in various parts of the country, is passing through a time of tribulation—like most other big electrical organizations in the United Kingdom. The continual bleeding of private electrical enterprise has for some time had a depressing effect upon investors and upon stock markets. It is taking a long time for the lesson to be properly learned that private companies exist for other things as well as carrying large numbers of workmen for next door to nothing, and the remaining members of the community at half penny or penny fares. But learned the lesson will have to be before long, if there is to be any profit earned and paid upon the capital which the public has found for the establishment of these systems. Last year on its entire lines, or those of its subsidiary companies, the British Electric Traction Company carried 300,000,000 passengers and the gross receipts were only £1,500,000, or 1.2 pence per passenger. Two-thirds of the electric tramways in this country are in the hands of municipalities which charge low fares, frequently without making profit, and piling up liability for track renewals without accumulating reserves to meet their cost. The public has not asked why these low fares have been possible, or whether it has been profitable to carry passengers at such low rates, and the inevitable result has been that other towns hearing of these low fares have pressed for similar charges wherever a company has been operating. Sir Charles Rivers Wilson, the chairman of the British Electric Traction Company, says that the time has come for a stand to be made against this perpetual clamor for reduction of fares and increased concessions. To the British Electric Traction Company the net result of this and many other adverse things is the absence of any dividend on the ordinary stock for the past year.

It will be timely to refer here to the latest statement issued from the electrical manufacturing world. The Electric Construction Company is the last to issue its tale of woe. Not only is there no dividend on the ordinary capital, but the preference shareholders are passed by as well this time, and there is a loss of £1,442. "Severe competition which has continued to prevail throughout the year in the electrical manufacturing industry"

is the principal cause, but "the increased price of copper and other materials has also been prejudicial, a corresponding increase in the price of electrical plant not having been obtainable." Happily the volume of business in hand is greater now than last year, and prices are said to have also improved somewhat. "Reasonable selling prices are alone necessary to restore the company's prosperity." That is practically what one has heard on every side for some time past, and an improvement is devoutly to be desired to lift the industry out of its present unhappy position.

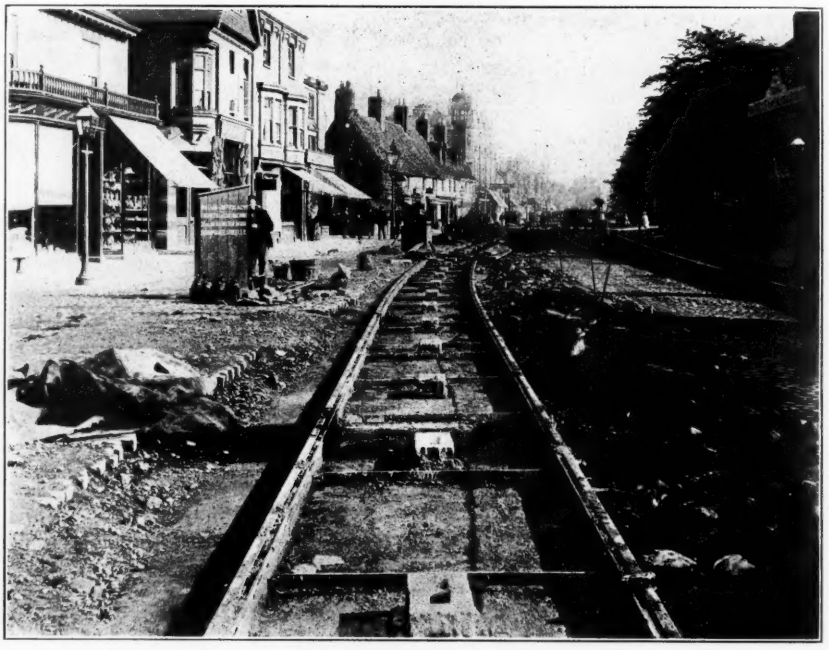
The London company operating the electric light and power supply undertaking of Wellington, New Zealand, was threatened with competition from the corporation, but on taking legal opinion as to its power to restrain the corporation it found that under its Act of Parliament it had no monopoly in the supply to consumers. The matter has now been the subject of negotiations between Mr. Salt, a director sent out from London, and the city council, and has ended in the city buying over the company's business as from July 31, for £150,000 in four per cent city bonds. The company has done very well on its last year's working, being able to pay a fifteen per cent dividend. Two years ago it lost the city public street lighting, as the council put in a plant for that purpose.

Some discussion has been proceeding between the postmaster-general and our tramway authorities concerning provisions necessary to be made by electric tramway undertakers for the protection of post-office telegraph lines. The postal authorities hold that one of the precautions which is essential for the protection of telegraphs from strong currents set up by accidental contact between the wires of the tramways or light railways and telegraph wires is the insertion in the telegraphs of fuses and heat coils which will prevent the communication of strong currents to the telegraph instruments. They contend that the tramway or light railway authorities ought to bear the reasonable expense incurred in providing these fuses and heat coils. The Light, Railways and Tramways Association has recently laid its views before the post-office solicitor (Sir Robert Hunter), and as a result the postmaster-general has agreed to let the matter go before an arbitrator.

Before my next monthly letter is complete, the British Association for the Advancement of Science will have held its annual meeting at Leicester (July 31 to August 7). Sir David Gill, formerly His Majesty's astronomer at the Cape of Good Hope, will deliver the presidential address. In the engineering section, over which Professor S. P. Thompson is president for this occasion, there are to be papers by Sir William Preece on Pupin's compensated cable for telephone transmission; by Professor J. T. Morris, of London, on an oscillograph study of Duddell arcs of low frequency; by Leon Gaster, on developments in incandescent lamps; by R. S. Ball, on the governing of hydraulic turbines; by Dugal Clerk, on the present condition of gas and oil engines, and by E. G. Coker, on the equipment of the engineering laboratory of the Finsbury Technical College.

The South Wales electric power undertaking, to the financial difficulties of which we have already referred in these pages, can not yet find its way out of the wood. Last year electrical experts stated that it was necessary to spend $2,500,000 further in order to put the undertaking on a sound footing, and financiers said they would find the money if 40,000 horse-power could be guaranteed under contracts for fifteen years. All negotiations with consumers have failed to make this possible, and since June, 1906, the undertaking has been carried on temporarily by an arrangement with the consumers under which they have paid such prices for current supplied as to keep the works operating without loss. Further new proposals are now about to come forward, and the chairman and other directors are retiring.

The government authorities will, during the next four years, spend nearly $30,000,000 upon extensions to the telephone service. Efforts were made by some in Parliament to get the amount reduced to half, making the postmaster-general come again when he wanted more, but they were unsuccessful. Others argued that at present the telephone was used only by the rich and that these ought to be made to pay higher rates for the service so that there might be no possible risk of a loss on working.



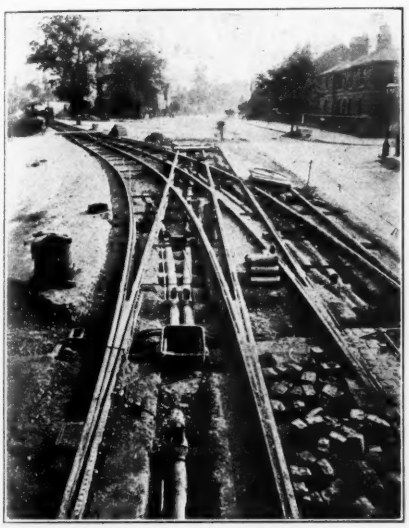
THE "G. B." SURFACE-CONTACT SYSTEM UNDER CONSTRUCTION AT LINCOLN, NOW PROPOSED FOR LONDON, ENGLAND.

It is stated that an extensive factory for the manufacture of metallic filament lamps is to be erected by the Robertson Electric Lamps, Limited, of Brook Green, Hammersmith, who have for some years been producing many millions of incandescent lamps per annum.

The King has conferred the honor of knighthood upon John Gavey, who, as stated in the ELECTRICAL REVIEW recently, retired from the post of engineer-in-chief of the general post-office. Sir John is a past president of the Institution of Electrical Engineers. Since his retirement he has become a director of the United River Plate Telephone Company,

and is understood to be devoting himself to wireless telegraph and telephone matters, in which he has long been an authority of eminence.

It is proposed to adopt the G. B. surface-contact system for the London County Council tramways between Aldgate and Bow. The cost is to be approximately $360,000, and the step is proposed as an experiment, so that the heavy cost of conduit equipment may be saved when further London lines are electrified. Some of the local authorities who have control of the roadways decline to allow the council to use the overhead trolley system in their districts and have clamored for the conduit system, which is adopted in other parts of the metropolitan area, regardless of the great capital cost. It is



The "G. B." Surface-Contact System Under Construction at Lincoln, Now Proposed for London, England.

the idea of the council that such authorities may agree to a surface-contact system. The cost of the underground conduit system per mile of single track would be $85,000, as compared to only $47,500 for the overhead trolley, a difference which has made itself sufficiently felt in the capital outlay already incurred to reduce a good deal of the prejudice against overhead wires. The G. B. surface-contact system is to cost a little more than the trolley, but a great deal less than the conduit, namely, $52,500 per mile, single track.

The proposed system is already in operation with considerable success on the lines of the Lincoln Corporation. The Lorain and Dolter road stud systems are in operation in other cities in the provinces, but the Lincoln G. B. lines have been regarded by the London Council tramway authorities as the best operating example to follow in their London experiments. The accompanying photographs show the system as in vogue at Lincoln.

Albert H. Bridge.

London, England, July 27.

Electrical Developments in Mauritius.

An interesting account is given in *Electrical Engineering*, of London, for July 18, by G. McAlpine of the electrical developments in Mauritius, an island in the Indian Ocean, 1,300 miles east from Natal. Its area is, roughly, 700 square miles; and its formation is volcanic. The population is, roughly, 400,000, mostly of Indian and negro descent. The first attempt at public electric light supply was made in 1895 at Curepipe, the modern residential town of the island. A small steam plant was installed, with alternating current at 1,000 volts, distributed by overhead wires to small transformers hung from poles. This equipment was used satisfactorily for twelve years, in spite of the rigors of the wet, tropical climate. Unfortunately, for various reasons, the undertaking was not attended with good fortune. An attempt to use meters failed, as the ones secured were not capable of withstanding the climate. Moreover, the price of coal was $10 a ton, and, as the load-factor was less than ten per cent, the works cost were high.

About the year 1900, a producer gas plant, with a 100-horse-power gas engine, was installed; but the labor available was incapable of caring for this plant, and it was abandoned. In 1901, a new company was formed, which undertook to develop the water-power of the Tamarind river, six miles from the town of Curepipe. There are several falls at this point, aggregating 1,000 feet in a distance of less than one mile. The flow of the river is variable, but it was found to be sufficient, with but little expenditure for storage works, to insure 1,000 kilowatts on a twenty-four-hour basis. The first apparatus installed was a 250-kilowatt generator coupled to a turbine. After some mishaps, this installation was put in operation, power being transmitted from the station at 6,600 volts or fifty cycles to transformer substations in all the principal centres of demand. A three-phase distributing system was employed, with 230 volts between phases. The streets are lighted by incandescent lamps. This company also supplies electrical energy for power and other purposes within three and one-half miles of the city. One trouble encountered was due to poor insulators. The dam and canal also gave trouble, so that a new one became necessary. A second dam was built a little further up the stream from the first one, and a new turbine and alternator were installed in the power-house. This equipment has an output of 250 kilowatts. These changes considerably improved the service. Another company was organized, and commenced operations in 1901 to develop the power of the Moka river, where there is a fall 150 feet high. A sixty-kilowatt turbine and generator set were installed, power being transmitted from the station of 2,200 volts to a number of villages within the neighborhood. In 1905, this plant was enlarged. To find room for the new equipment, it was necessary to excavate a chamber in the side of a cliff. Here, a 100-horse-power turbine coupled to a seventy-five-kilowatt single-phase alternator was placed. Power is supplied from this unit for factories in the neighborhood. In 1905, the municipal government of Port Louis commenced the development of the water power of the Grand river northwest, where there is a waterfall eighty feet high four miles from the city. A seventy-five-kilowatt single-phase alternator has been installed. Power is transmitted from the station of 5,000 volts to the city, where it is reduced to 220 volts for street and public lighting. The only other electrical installation of any size is that of the government railway station at Port Louis, where fifty incandescent lamps are operated by a small generator driven by an oil engine.

The Brilliant Electric Company Meeting.

The first annual meeting of the salesmen of the Brilliant Electric Company was held on July 29, 30 and 31. Monday, July 29, was spent at the old factory of the Brilliant Electric Company at Cleveland, and a complete investigation of the new plant at Conneaut, Ohio, was also made. On Monday the Brilliant representatives held a conference with the Engineering Department of the National Electric Lamp Association.

Tuesday, July 30, headquarters was established at the Hotel Victory, Put-in-Bay Island, Lake Erie, a boat trip from Cleveland being one of the features. Here there was a delightful reunion of the officers and salesmen, many of the Brilliant Electric Company's jobbers also being present.

The meeting broke up on Wednesday evening, July 31. Splendid progress was reported from each territory, and the organization throughout is enthusiastic over the outlook for a busy fall and winter campaign.

REVIEWS OF CURRENT ENGINEERING AND SCIENTIFIC LITERATURE

High-Speed Wireless.

An account is given here of some recent experiments made by William Marconi to apply the Wheatstone system to wireless telegraphy, in order to increase the speed of transmission. For this purpose, a Wheatstone telegraph transmitter actuating a heavy type of relay which made or broke the primary circuit of the spark-coil was used. During the tests, the aerials were only a few feet apart, and fair results were obtained at speeds of about forty words a minute. Later, the British post-office carried out preliminary experiments with the Wheatstone system between two stations fifteen miles apart. In these experiments, the received oscillations actuated a wireless receiver, which in turn acted on a syphon recorder, causing the Morse signals to be written in a continuous wavy line. At slow speeds, the signals received were very distinct and the ink line steady. This was true up to thirty-five words a minute. Some trouble was experienced at the sending end with the make and break contacts used, but, in spite of this, distinctly readable messages were transmitted at speeds up to seventy words a minute. At ninety words a minute, the signals became unreadable. At the latter speed two limiting factors were encountered—the speed of the syphon recorder and its particular adjustment and the rate of sparking. These troubles can be eliminated, so that it is likely that good signals may be obtained at speeds above seventy words a minute.—*Abstracted from Electrical Review (London), July* 19.

Laboratory Apparatus for Measuring the Force of a Current-Carrying Conductor Lying in a Magnetic Field.

The method used by Ampere in his investigations of the effect of the magnetic field on a current-carrying conductor was to arrange the conductor so that the forces acting on one part of the circuit just balanced those acting on another part. This method, however, is not simple, and not easily applied in the laboratory. Professor R. A. Porter here describes a device which he has made for demonstrating this law and which is so simple that it may be used satisfactorily by students. On account of the small strength of the earth's magnetic field, it is necessary, in making such measurements, either to use a large current or else measure delicate effects. These difficulties are avoided in this instrument by replacing the earth's field by a C-shaped, cast-iron, cylindrical magnet having an air-gap four millimeters wide. A conductor is arranged within this gap, which is carried on a rocking wooden frame. The conductor is U-shaped, and current is transmitted to it through the steel pins upon which it rocks, these being placed in mercury cups. The force acting upon the conductor is balanced by a spring of the Linebarger type. Current in both the conductor and in the magnetizing coil is measured by convenient ammeters. The author gives sets of readings illustrating an experiment with this apparatus, and deduces from it figures illustrating the principle of Ampere's law, due to the hysteresis of the iron, as error may be introduced if the particular phase of magnetization be not known. The accuracy of the device in its present form is about three per cent. A valuable feature of it is the directness with which the force upon the conductor is obtained in terms with which the student is familiar.—*Abstracted from Science (New York), July* 12.

Compounded Alternators with Commutators.

A description is given here by A. Heyland of several alternators compounded according to his methods. Several of these machines have been in operation for some time with, it is said, good results. Three of these are in the lighting station at Valenciennes, where they have been in constant operation since early in 1905. These machines were designed for an output of 390 kilowatts, at a speed of 375 revolutions per minute, and a frequency of fifty cycles a second. Two machines, rated at 450 kilowatts, at a speed of eighty-three revolutions per minute, and a frequency of twenty-five cycles, have been installed in the works of the Societe Metallurgique de Senelle-Maubeuge, Longwy, and have been in constant use since 1904. The operation of these machines has shown that no commutator troubles need be feared, and there is no difficulty in running a number of such machines in parallel; for the three alternators of the first installation just mentioned have been so operated. In this plant, the compounding transformers are connected by equalizing conductors, with the result that the compounding effect is common to all three machines. In consequence, the mutual behavior of these alternators is exactly the same as with three alternators of the ordinary type working in parallel. It has been found from the experience with these compound machines that it is advisable to design them with stiff fields, and not too small a density for the field flux. The explanation is that these alternators, being self-exciting, should not be too sensitive to fluctuations in the engine speed, in which respect they resemble ordinary continuous-current dynamos. A point requiring more attention relates to the behavior of compounded alternators when dealing with heavy leading currents. Such currents may cause the machine to lose its excitation, especially if it be of small size. This phenomenon was first observed in small, experimental machines; and it was some time before the trouble was located. These machines had been intended for use as automatic voltage regulators in lighting net-works. They were not intended to supply current, but were merely to be used as motors running light, and connected to those points of the lighting system at which the voltage was to be kept constant. The machines acted well for a while in the desired manner by supplying to the circuit sufficiently large magnetizing current to keep the voltage constant; but afterwards, it fell out of step several times, without cause. The same phenomenon occurred with several machines. The trouble was finally found to be due to the leading currents through the compounded alternator, resulting from the rise in pressure of the main alternator when the load diminished. Since a lagging current causes an increase in the field of a compound alternator, a leading current must have a weakening effect; and this weakening effect occurs at an accelerated rate, owing to the simultaneous decrease in the operation. For this reason, the compounded alternators lose their pressure, and fall out of step, when loaded with a leading current of suffi-

cient strength or phase-displacement. The trouble was overcome by reducing somewhat the excitation of the main alternators, so as to insure that the compounded alternators with which they run in parallel have constantly to deal with lagging currents. The phenomena, as mentioned, is due to the curved nature of the characteristic, caused by the saturation of the iron, the result of which is to change the degree of compounding according to the load. It could be overcome if the compounding characteristic could be reversed, which might be done by a special arrangement of the compounding transformers; but the remedy already given is the better.—*Abstracted from the Electrician (London), July 19.*

The Operating Costs and Revenues of Urban Railways.

An analysis is given here by G. D. Werner of the last annual report of the Interborough Rapid Transit Company of New York city. This company is operating 118 miles of elevated track and 71.4 miles of subway track, making a total length of track of 189.4 miles. The total length of road is 59.47 miles. The rolling stock of the subway consists of cars fifty-one feet in length, the motor-cars being equipped with motors aggregating 200 horse-power. During the year ending June 30, 1906, 820,000,000 passengers were carried by the public transportation lines in the boroughs of Manhattan and the Bronx, about one-half of these being handled by the elevated and subway systems. The total car mileage of these systems was 93,654,185. From report, it is found that the maintenance of way and structure costs 0.0996 cent per car mile. The maintenance of equipment costs 1.214 cents per car mile, the chief item here being maintenance of the cars. The operation of the power plant costs 1.965 cents per car mile, the largest item being that for fuel, which was 1.193 cents. The next in size was the item for wages, this being 0.513 cent; to operate the cars, it costs 3.8 cents per car mile, the largest item here being that for wages, which was 3.31 cents. The general expenses were 0.9971 cent a car mile. In percentages, these items are as follows: Maintenance of way and structure, 11.1 per cent of the operating expenses and 4.73 per cent of gross earnings; the maintenance of equipment, 13.54 per cent of operating expenses and 5.78 per cent of gross earnings; operation of the power plant, 21.9 per cent of operating expenses and 9.36 per cent of gross earnings; operation of cars, 42.35 per cent of operating expenses and 18 per cent of gross earnings. The general expenses were 11.11 per cent of operating expenses and 4.74 per cent of gross earnings. The total operating expense was 42.69 per cent of gross earnings. An analysis of these figures shows that the maintenance of the cars is high, probably on account of the large size of the equipment and the type of control. The cost per car mile is low. The total cost for maintenance of equipment compares favorably with that of other roads. The item "fuel for power," which forms sixty-one per cent of the total power plant operation, affords a fruitful topic for reflection on what are probably the most efficient power plant expenses. H. G. Stott, superintendent of motive power, has shown that the thermal efficiency of the Interborough plant is 10.3 per cent, with coal of 14,150 British thermal units. One kilowatt-hour, therefore, represents 2.34 pounds of coal at the coal pile. Since this coal costs about $3 a ton, the real significance of the coal item will be appreciated. Using these figures, the cost of coal per kilowatt-hour is found to be 0.349 cent, which may be compared with the cost of fuel of 0.55 cent per kilowatt-hour at the power stations of the Boston Elevated, where coal costs $3.60 a ton. L. B. Stillwell has said that the works cost per kilowatt-hour at the bus-bars of the Manhattan plant is less than 0.6 cent. In the operation of the cars, labor charge predominates; but this is small as compared with the corresponding item for a number of typical electric railways, where it averages 5.9 cent per car mile. The low figure of the Interborough is, no doubt, due to the long trains which are run. The total operating expense per car mile is low. It illustrates the performance which is attainable with large and efficient engineering lay-out and vigilant management. The fixed charges on the system are 9.441 cents per car mile. The gross earnings from operation are 21.03 cents per car mile. The net income is 3.39 cents. The author holds that this analysis shows that the earnings of the company are not inordinately large, and, notwithstanding the most mechanical design and operation and the most able business management, the large fixed charges operate to cut down the earnings considerably, and make the money invested yield only a moderate dividend.—*Abstracted from the Engineering Magazine (New York), August.*

Mercurous Sulphate, Cadmium Sulphate and the Cadmium Cell.

Since some question was raised regarding the constancy and reproducibility of the cadmium standard cell, investigators have been studying this cell, in the endeavor to locate the uncertainties and eliminate them. In this article, G. A. Hulett gives an account of his investigation to determine whether there was any inter-action between the cadmium sulphate solution and the mercurous sulphate of the depolarizer. From the standpoint of the electrolytic dissociation theory, it might be expected that mercurous sulphate would be less soluble in a cadmium sulphate solution than in water, since both salts have a common ion; but the solubility is found to be about five times as great in a saturated cadmium sulphate solution as in water, and this fact suggested that the common ion might be ineffective in producing hydrolysis of the mercurous sulphate. Accordingly, an apparatus was devised by which the cadmium sulphate and depolarizer portion of the cell might be rotated, in order to see what effect time had upon the cell. Results show that the rotated system did not come to equilibrium, even after being rotated for a month. It was thought that oxygen dissolved in the solution might effect the cell, and, to test this, cells were set up in an atmosphere of hydrogen, care being taken to drive off all oxygen from the solutions by bubbling hydrogen through. Variations in the cell were still found, indicating that dissolved air played no rôle in these experiments. One effect noticed was the abnormal solubility of the mercurous sulphate when finely pulverized. There seemed to be two oppositely directed changes taking place in these cells. One is assumed to be hydrolysis of the mercurous sulphate, which increases the mercury concentration of the solution, while the other and slower change is evidently a secondary action of the mercury on the soluble products of hydrolysis. This secondary action occurs only when the basic salt was or had been present, and it causes a decrease of the mercury concentration of the solution. It is probable that cadmium cells made with the fine-grained depolarizer of good depth would show less variations than those made with coarser material, but a standard cell, which depends on the mechanical condition of the solid materials, is in unstable equilibrium, and must be less reproducible and less constant than cells which are free from these defects. It was found that, when a little sulphuric acid was added to the cell, they seemed to be more stable; but these cells have not been under observation long enough for their constancy to be judged.—*Abstracted from the Physical Review (Lancaster), July.*

Methods of Getting New Business

A DEPARTMENT DEVOTED to the COMMERCIAL DEVELOPMENT of CENTRAL STATIONS

Managers are Invited to Contribute Suggestions for Methods of Increasing the Demand for Electric Service

EDITED BY CHARLES A. PARKER.

The Electric Arc versus the Gas Lamp.

BY E. A. CREED.

The so-called "gas arc" is a lamp containing two, three, or four Bunsen burners, through which the gas is caused to pass and then ignited. The mixture burns on the top of a gauze cap producing great heat and but very little light. This heat is transformed into light by means of a hollow tubular network which is suspended over and around the burner by a wire support. The network, or "mantle," as it is called, was the invention of Auer von Welsbach, a German scientist.

It is needless to say that the learned German's invention revolutionized the gas industry.

The mantle is made by dipping a woven cotton cloth into a solution of several earthy oxides, such as magnesia, zirconia, etc. The mantle is then baked and finally the temperature is raised high enough to destroy the cotton fiber, leaving the coating of oxides standing as a crust. The mantles are very fragile, so that their life is correspondingly short. The mantle becomes very brilliant when heated, thereby emitting light—a white dazzling glare, very trying to the eyes. The ordinary "gas arc" of commerce consumes about $24 worth of gas every year. The lamp is seldom used during warm weather, as it throws an intense heat, drawing flies and insects if placed outside, consuming what little oxygen there may be, if in a room or store; so it must be considered during the long-burning months.

Each Bunsen burner consumes five cubic feet of gas every hour. You may have heard it said that the consumption is far less, but the latest meter, the so-called "5 A," registers the amount stated. The meter registers five feet at twenty-tenths the usual pressure.

A four-burner lamp will consume twenty feet of gas per hour. The lamp will average twenty-six nights a month, 2,080 feet consumption.

One lamp in a store is absolutely useless. It gives very poor illumination and casts objectionable shadows. The average candle-power of the lamp is 240 against 1,200 in an electric arc. For every additional lamp installed means a consumption of $2 worth of gas extra.

Mantles, as we have learned, are very fragile; they are also very expensive.

A man can not use the four-burner gas arc lamp under $30 to $35 per year. He must renew his old lamps. They rapidly fall to pieces; the heat causes oxidation of the mantle, leaves a black, sooty deposit on walls, fixtures, white goods and ceilings. Repapering at least once a year is absolutely imperative if one possess a love of cleanliness.

Dollar to dollar gas is cheaper than electricity, but kerosene is cheaper than gas, and candles have kerosene beaten three ways. But try to light your house with candles.

That will mean money.

Candles and oil were good enough for our grandfathers.

Gas was good enough in the eighteenth and nineteenth centuries, but we are now living in a new era, the twentieth century, a period of progress.

Our latest light is the electric light—a safe, convenient, efficient and cleanly means of illumination, and the nearest to nature's great lamp, the sun, to which man has attained.

As all you gentlemen have learned since you have been selling goods, the average individual is staggered at the first cost of an article.

The writer has had some experience in the gas and electric business, and without egotism regarding his commercial successes, and solely for the purpose of encouraging the members of the sales department he can, with all due modesty, say that he has replaced gas lamps with electric arc lamps in more than one bitterly contested campaign.

In a city of 560,000 population, the electric lighting company, with which the writer was connected, was competing with natural gas at thirty cents per thousand cubic feet. The rates for electric service averaged twelve and one-half cents per kilowatt-hour. The company furnished lamps free, maintained them without cost to the consumer, and tried by frequent calls, square dealing and courteous treatment to hold its customers.

The charge for a gas lamp was $11.50; fifty cents per month was charged for maintenance. To get a gas man to repair a lamp, supply a broken mantle, or clean a globe was very hard. That was the electric lighting company's strongest argument; the maintenance of the lamp.

Once a lamp is sold to a customer by

A HINT to the HOSTESS
The cheerful blazing brilliancy of electric light will do half your entertaining for you.
In a large room it brings people nearer together---breaks the ice---it annihilates formality just as it does distance.
Enjoyment and merriment are always at hand where electric lights are used, for a kind, clear, vivid light wipes out dingy corners and solemn reflections.
If the hostess wishes to guarantee the success of an evening entertaining, she should first flood her house with electric light, shaded or tinted if she prefers, but not subdued.
Let us show you how
Do it right now.
Home 1306 Jackson Railway & Light Company Cumberland, 36
DO YOU KNOW
Electric Lighted Home
JACKSON RAILWAY & LIGHT CO.
Electric Lights
If You Would Economize
Adopt Electric Lights
GET YOUR HOUSE WIRED
RING OUT THE OLD, RING IN THE NEW.
JACKSON RAILWAY & LIGHT CO.

A few striking newspaper advertisements of the Jackson Railway and Light Company. The designs are excellent and the text is strongly and convincingly written, showing them to be a very high type of central station newspaper advertising.

the gas salesman, that settles him. They won't keep their promises. They have his money, he has the lamp. He contracts to pay for the maintenance but it is not specified how often his lamp is to be repaired, how many mantles are to be replaced, nor is he promised a new lamp when the old one becomes useless.

That matter was pointed out clearly. The company would show a man that it trimmed lamps at least once a week.

It showed him that it was interested in him forever and a day, for he had a lamp of the company's in his possession worth $25.

He was told that it was interested in the conditions of his appliances, for if they were not in good working order, how could they consume current?

It was explained to the man that every up-to-date merchant, the really successful merchant, would no more think of installing a gas lamp in his establishment than he would a tallow dip.

It would convince any intelligent prospect that the crowd, like the moth, was attracted by a bright light and it would ask him to take notice of some benighted individual who was using a dim-looking gas lamp, and they are all dim, the lamp as well as the consumer of gas, and ask him if he would not rather have a bright, beautiful, clean and cool lamp, even though it did cost a few pennies more, than the burnt cone of his neighbor.

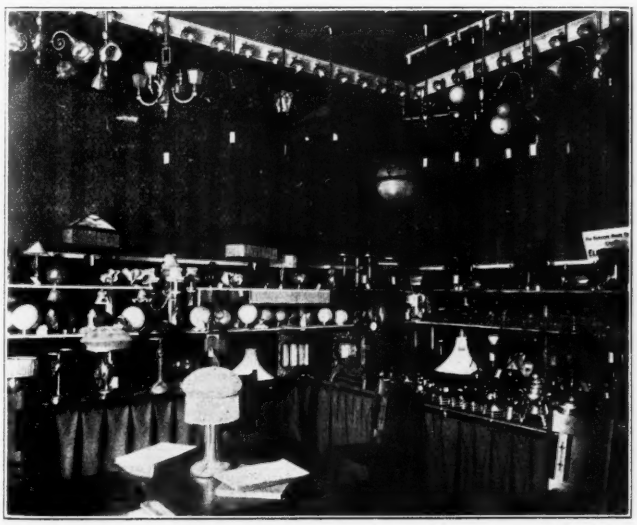
It would show him that broadcloth costs far more than shoddy, but when it came to giving satisfaction and wear, shoddy was the dearest stuff a man could buy.

It could give a customer far more light with two electric arcs than he could get from four gas lamps. The gas lamp salesmen are salesmen of high order. They must be or there would be few lamps in use, for they will not sell themselves.

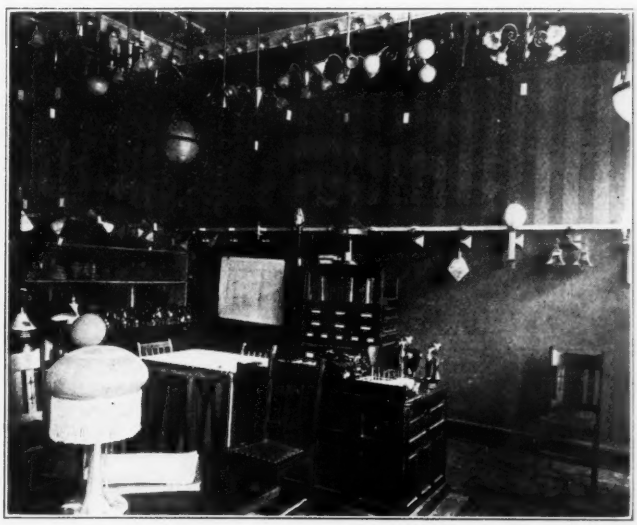
Gentlemen, you are salesmen, and I say without flattery that you are clever sales-

Showing a section of the general office of the Jackson Railway and Light Company. The man nearest the window is Mr. Richardson, the energetic manager of the business-extension department, whose work with the Jackson company has attained for him a wide-spread reputation.

Offices and office force of the Jackson Railway and Light Company, showing the good use they have put their available window space to and the example they are setting the merchants of Jackson in the way of a bright store front.



Section of the handsome display room of the Jackson Railway and Light Company.



Another corner of the attractive and well-arranged display room of the Jackson Railway and Light Company. This room is one of the most finely equipped, best stocked and up-to-date display rooms of its kind in the South.

men; if you were not, you wouldn't be here. You can, by using the diplomacy, tact and ardor with which you are blessed, meet the so-called gas competition.

If four men in a country town of 12,000 could throw out every gas arc in the place, if in a natural-gas city six men could hold ninety per cent of the electric arcs threatened, you can do it here.

Let me cite you an example: the gasolene engine.

You all know gasolene is cheaper than the electric current, yet this department has displaced innumerable gasolene engines.

Don't you think because a store is opened on Westminster street, a few glaring lamps hung up outside and half a dozen slick gentlemen are selling goods that you are candidates for the "down and out" club.

Up and at 'em.

Put vim into your attack.

Get data on illumination, on conflagrations from open-flame burners, on hygienic effect of gas and if you can't hold or close a man, tell the department head. Let him try. You are a commercial man, and you must hold your customers.

In a sales department, your knowledge of technical matters is not considered so much as your ability to convince men that you have the safest, surest, sanest means of illumination on top of God's planet. The most satisfactory artificial illuminant will be that whose properties most resembles sunlight in color. The most eloquent of the gas lamp advocates can not but admit that the light emitted by the gas lamp is not akin to the color of the sun.

The incandescent electric lamp possesses certain qualities that ranks it easily an ideal illuminant. It is safe, cheap, hygienic, steady, reliable, portable, cool and ready.

As regards safety, no open-flame burner is safe.

(To be continued.)

"By Soft Persuasion" is the title of a unique and excellent piece of central station advertising which is being sent out by a number of progressive companies.

The cover design is simple but very striking and attractive; the inside illustrations are excellent: and the text matter is written in the form of an exceedingly interesting and convincing story.

A few of the interior illustrations and cover design are shown above.

It will be our endeavor to present in this department notices of activities among central stations, gathered from men who are in the field and, consequently, in close touch with the progress of the new-business idea and its acceptance by central station managers. Contributions to this department are solicited, and will be received with much appreciation by the editor.

If you are doing something a little better than or different from the other fellows, and think it would make interesting reading to ELECTRICAL REVIEW readers, send in your schemes and plans. They will be gladly received.

Address all communications to Charles A. Parker, care of the ELECTRICAL REVIEW.

Jackson, Tenn.—Bringing the business of a central station from practically the zero mark up to the sale of 10,000 sixteen-candle-power equivalents in the short space of five months is something that few men can boast of.

It seems on the face of it almost an impossibility.

Nevertheless, this is exactly what has been accomplished by R. W. Richardson since he took his place as director of the business-extension department of the Jackson Railway and Light Company, of Jackson, Tenn.

Mr. Richardson took charge of the company's business in November, 1906, and he has made this wonderful showing in the short space allotted him up to the present time.

He was employed by the Columbia Trust Company, of Louisville, Ky., who also operated a central station at Rome, Ga., and he had charge of the business of both plants, but devoted his greatest efforts to the Jackson plant.

On his advent in Jackson he found a central station equipped with out-of-date machinery which would furnish, at the best, only a limited amount of current. The service was extremely unreliable and customers generally dissatisfied.

In fact things could not have been in a more run-down or deplorable condition. The people, as a whole, were disgusted with electricity.

Merchants did not know what minute their stores would be left in total darkness, or what day they would be forced to close their stores at sundown.

Electrically lighted homes were poor places to hold an evening entertainment, unless oil lamps or gas could be brought into use when something went wrong at the power plant.

Manufacturers, shops or users of elec-

tric power felt much safer with the unreliable gas engine or steam power than they were with the electric motor.

Such was the condition of affairs to welcome the advent of Mr. Richardson.

Now let us see what this hustler accomplished, and how he did it.

He, with the valuable aid and backing of S. S. Bush, vice-president and general manager, and Jack Abbots, electrical engineer, immediately made plans to install steam turbines of 300 horse-power each, giving his plant the finest equipment of any central station in the South, and putting the company in a position to deliver plenty of electrical energy and furnish reliable and uninterrupted service, twenty-four hours a day.

He then proceeded to assure present users of juice that in the future their lighting rates would be almost cut in two and that they would be furnished with only dependable, trustworthy service.

He secured the cooperation of contractors, builders and architects, and had them specify wiring wherever possible.

He opened a display room on the public square, which is a little model.

In it were displayed all the electrical household devices, and a courteous young woman was placed in charge to demonstrate to the public the uses and conveniences of the different electrical contrivances.

For his soliciting force Mr. Richardson selected three bright, hustling young men and educated them for their field of usefulness.

The young fellows have developed wonderfully under the guidance of their competent teacher, and are turning into the company a bountiful harvest of new business.

Power business was pushed to the limit and a large number of installations were made through the personal efforts of Mr. Richardson, his excellent ability as a salesman and his technical and practical knowledge as an electrical engineer standing him in good stead.

Mr. Richardson, knowing the value of advertising, has carried on a persistent campaign of newspaper publicity, which has done much to increase the sale of current among resident users.

The company, however, does not intend to stop at newspaper advertising, for it has made arrangements to issue a monthly "Electrical Bulletin."

The management is convinced that of all the advertising which central stations can use, there is none so productive of good results as a well-edited, attractive and interesting bulletin sent through the mails to selected lists of residents, stores and business places and users of power.

It believes that a bulletin issued from month to month will have an accumulative value far exceeding in forcefulness a mere haphazard or spasmodic plan of advertising.

Besides the bulletin, the company expects also to inaugurate two special direct-by-mail advertising campaigns in the form of folders, booklets, mailing cards, etc. One to prospective sign users and another to users of power. Each of these special campaigns will cover a year and will consist of twelve different pieces of advertising to be mailed out monthly.

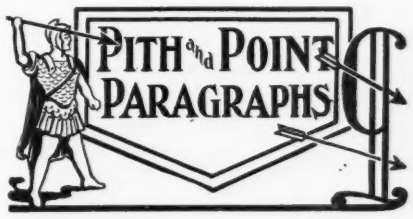
Cover of an exceptionally good piece of direct-by-mail advertising which was used by a number of central stations to show merchants and business men the value of the electric fan for their place of business.

If such concentrated and persistent advertising is indulged in, Mr. Richardson and his company can not fail but make an even better showing than they have during the first six months of Mr. Richardson's directorship of the business-extension department.

The company has also constructed and is running an electric park on its traction system, which gives promise of being a very successful undertaking.

As a little piece of diplomacy, the company installed an efficient lighting equipment for the town clock gratis, and is supplying current on the same liberal terms.

On the whole, Mr. Richardson has accomplished phenomenal results for a southern town, and his work is worthy of the highest praise. He is about to establish an office as consulting commercial engineer and devote his energies to business extension for central stations, and his services should be of great value to central stations wishing to get out after new business, or place their plants on a better paying basis.



Under this heading we shall present a series of inspirational aphorisms (original, aboriginal and selected), which will, we believe, prove stimulating and suggestive to those who are interested directly or indirectly in the sale of central station current.

Consistency and persistency are a winning combination—employ them in your soliciting.

To inspire confidence you must be confident—don't make excuses for electricity—it needs none.

Get down to your subject—fill up on it—bubble over with information about the advantages electricity will mean to that prospect.

You can not get ahead by calling on the other fellow to stop.

It's easy to drift—success comes by pulling against the current.

Good cheer is the moral equivalent to money in the bank.

A little constant application each day acts as a whetstone to the brain.

Study some one point till you have that point where it won't get away.

Determined incompetence wins more fights (more orders) than faint-hearted genius.

That prospect really don't want to pass up a good thing—show him that electricity is a good thing.

Don't bottle up your enthusiasm—let it out.

Time is the stuff life is made of—do not squander it.

There is always hope in a man that actually and earnestly works.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

The Warren Electric Manufacturing Company.

The Warren Electric Manufacturing Company, Sandusky, Ohio, due to unfortunate experiments with a steam turbine it expected to place on the market, went into the hands of receivers, October 25, 1905, and the business was sold out by the court at public sale to the highest bidder, March 6, 1907.

The purchaser was the "Warren Electric Manufacturing Company," Sandusky, Ohio, a corporation incorporated for $175,000, all paid in.

As a result, the new company has plenty of working capital and already has installed several modern machine tools, besides having many more ordered which will be delivered shortly. Consequently the company is in shape to not only reduce costs to a minimum, but insure customers the very best of workmanship.

The old company only manufactured alternators, and of the inductor type, of the comparatively smaller sizes, whereas the present company manufacture both inductor and revolving-field alternators up to 750 kilowatts. A view of the shop herewith shows several of the large size machines in course of construction.

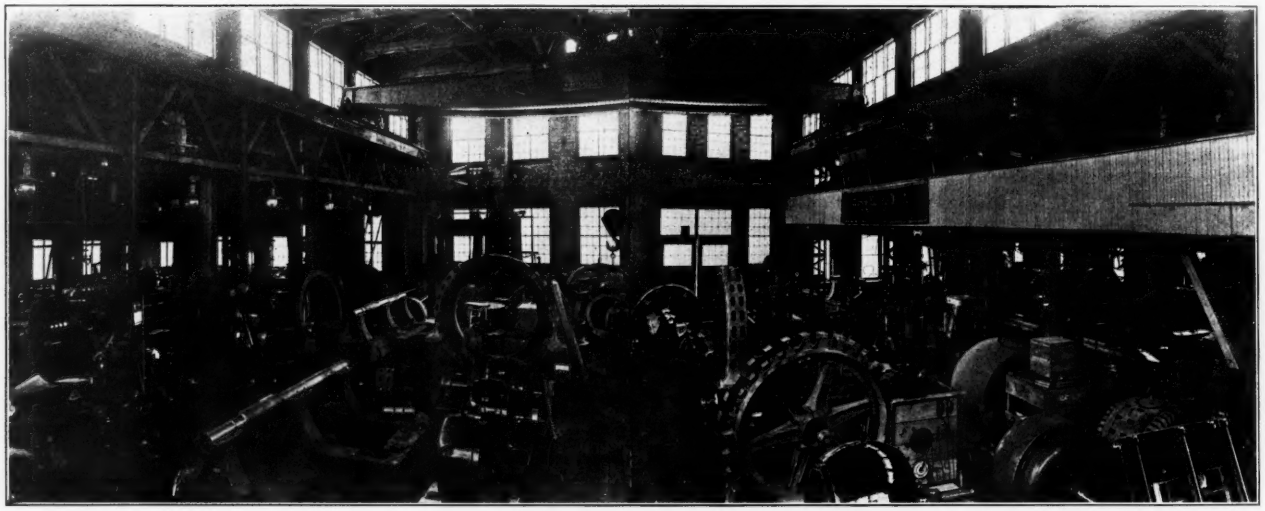
The company is about to place on the market a full line of alternating-current and direct-current motors, which will have some novel features that will interest users of this type of apparatus.

The officers of the present company are Millard H. Nason, president, who is also vice-president of the Brilliant Electric Company, Cleveland, Ohio, and is well known in the electrical field.

Norman L. Hayden is vice-president and general manager, who for ten years was president of the Hayden & Derby Manufacturing Company, New York, also founder and manager of the N. L. Hayden Manufacturing Company, Columbus, Ohio, in which he is still a very large stockholder.

Frank Warren, secretary, who for a term of years was sales manager of "The Warren Electric Manufacturing Company," and who is an exceptionally able salesman of alternating apparatus.

The company's machines will be placed on the market under the trade-name "Wemco."



MAIN BAY OF THE SHOP OF THE WARREN ELECTRIC MANUFACTURING COMPANY, SANDUSKY, OHIO.

Philadelphia Electrobuses Meeting with Success.

The twelve electrobuses which have been placed in commission in Philadelphia, on Broad and Diamond streets, by the Auto Transit Company, are being well patronized and the company is making every effort to complete its garage facilities and increase the number of vehicles to fifty. The buses are identical in style with the London type of bus, with upper and lower decks.

Mechanical Draft for Government Fuel-Testing Plant at Jamestown Exposition.

The valuable results obtained by the United States Geological Survey at the St. Louis Exposition in determining the actual steam-making values of American fuels is to be continued with a similar plant at the Jamestown Exposition. The report on the St. Louis tests, which fills three large volumes, is devoted largely to fuels from the Middle West and western coal fields. The plant now being erected at Jamestown will give an opportunity for analyzing, testing and placing on record in a similarly thorough and comprehensive manner the coals from the eastern fields. The Jamestown plant will contain three 300-horse-power boilers, each equipped with an engine-driven, 100-inch, mechanical-draft fan and a thirty-five-foot stack, both supplied by the Green Fuel Economizer Company, of Matteawan, N. Y. The fans will be so controlled that the draft can be regulated as desired by hand or automatically. The wheels of the fans measure five feet in diameter by two and two-thirds feet width at the tips of the blades and are driven by six by seven-inch Green vertical centre crank engines. The laying out of the mechanical-draft plant was entrusted by the survey to the Green Fuel Economizer Company.

Brooklyn Edison Entertains Local Contractors.

The Edison Electric Illuminating Company, of Brooklyn, on Tuesday, July 30, entertained the electrical contractors of Brooklyn at the Brighton Beach Hotel, Coney Island. Upon arriving at their destination, whither they were transported in chartered trolley cars, a group photograph was taken on the steps of the hotel.

Outing and Banquet of Brooklyn Contractors as Guests of the Edison Electric Illuminating Company of Brooklyn.

Immediately thereafter, a banquet was served.

W. W. Freeman, vice-president and general manager of the company, congratulated the electrical contractors of Brooklyn upon their growth in numbers and prosperity, as unmistakably evidenced by the company present. He dwelt upon the mutual advantages to be obtained by cooperation between the contractors and the electric lighting company, and cited figures to show that expenditure of money and effort on business-getting methods, such as advertising and soliciting, have proven exceedingly profitable to the company, and would doubtless prove equally profitable to the contractors. He urged them to increase their efficiency as business-getters.

James R. Strong, president of the National Electrical Contractors' Association, was the next speaker, and he also emphasized the necessity for cooperation between contractors and company, and also upon the advisability of cooperation among the contractors themselves.

E. J. Theimer, president of the Long Island Contractors' Association, and C. A. Christensen, president of the Independent Contractors' Association, also spoke for the contractors, while W. F. Wells, operating superintendent, and P. R. Atkinson, treasurer of the Edison company, spoke briefly on matters of mutual interest.

J. C. Forsythe, chief inspector of the New York Board of Fire Underwriters, delivered an excellent address on the importance to the electrical interests of the body he represented, and urged upon the contractors, for their own sakes, as well as for the welfare of the community, the necessity for doing their work in the best and most thorough manner possible.

T. Beran spoke for the General Electric Company, which he was present to represent.

After the speech-making, the guests were given their choice of an evening at Luna Park, or at the Brighton Beach Music Hall.

Among those present at the banquet were the following:

C. A. Christensen, F. C. Bates, J. C. Forsythe, P. R. Atkinson, J. R. Strong, W. W. Freeman, W. F. Wells, G. E. Bruen, T. Beran, J. F. Becker, Jr., E. J. Theimer, M. S. Seelman, Jr., A. W. Brown, H. Fallek, L. Hirstenstein, George Weiderman, T. J. Little, F. Rhoades, L. Bateman, E. W. Babcock, Sabel & Son, Mr. O'Byrne, G. McMullen, H. B. Morris, J. J. Sheran, H. F. Frasse, W. E. Hurley, B. Wall, E. A. Bailey, Manquis & Son, W. F. Hutchinson, I. Bugg, George H. Rice, C. A. Barton, W. T. Fairbairn, M. S. Brown, F. A. Armstrong, A. S. Beach, William Yeager, W. Huth, L. Levine, F. G. Schaefer, F. H. Ward, W. B. Sheldon, R. D. Langley, H. W. Bishop, C. Wells, J. E. Weismandel, P. O'Rorke, R. J. Ward, J. H. Porter, R. Findlay Manufacturing Company, L. R. Abel, W. A. Perry, A. Helwig, H. E. Conklin, S. A. Chase, H. P. Wood, T. H. Cooper, W. E. Sands, W. F. Force, G. Sabel, Mr. Sleaster, C. L. Knight, F. M. Barrell, L. Kallisher, J. L. Kruger, T. Boudreau, Ward & Son, D. Murphy, J. D. Coveney, C. F. Tuttle, Harding & Roth, H. Hochhausen, P. D. Sharkey, F. A. Walter, E. Latham, H. G. Mandeville, A. H. Kirchner, H. H. Hornby, F. G. Blanchard, C. W. Brown, Emergency Electric Construction Company, A. Moore, J. W. Lafferty, H. E. Green, C. R. Wood, J. J. Leddy, W. Grete, C. W. Lanig, C. A. Graves, W. Ferris, R. Manquis, C. E. White, Martin Electric Company, C. T. Woodward, Roger Williams, H. W. Scandlin, Johnston & Sloan, J. A. Kenny, Vosburgh Manufacturing Company, T. N. Hicks.

Current Electrical News

DOMESTIC AND EXPORT.

CHICAGO TELEPHONE GRANT VOTED—The ordinance of the Chicago Telephone Company, amended to include a $125 flat rate for business telephones, was recommended for passage to the council by the committee on gas, oil and electric light on July 26. The minority will now endeavor to fight against several features of the ordinance when it comes up before the council in September.

BIG POWER PLANT AT HATFIELD, WIS.—The La Crosse Light and Power Company has bought all the land surrounding Hatfield for the purpose of establishing a large electric power plant there. The village lies close on the right bank of Black river and it is this stream which will furnish the water power for the gigantic undertaking which is now only just begun. A concrete dam larger and higher than almost any other in the state is to be constructed. A canal two and a half miles long is being dug for the purpose of turning the main stream from its present course and allowing opportunity for the building of the dam. Five hundred men and a great number of teams are now employed there and the cost of the work reaches into the thousands of dollars. It is estimated by some of the officers there that the expense will not fall short of $7,000,000. The object of the enterprise is to furnish electric power for as many places as want it, among the chief cities being La Crosse and Winona, Minn.

POWER PLANT AT MARSEILLES—W. D. Boyce, of Marseilles, has under way a plan for developing considerable power at Marseilles, Ill. As it now stands his water power at Marseilles gives him a surplus of 5,000 horse-power to dispose of. With an increased drainage flow, this will be increased in a short time to 10,000 horse-power. It is his intention to dispose of this power up and down the Illinois valley. He has a franchise for a pole line along the banks of the canal. It will run down to and through the city of Peru, and will run up to and through the city of Joliet. Another line of poles will also be run across the country to Streator. This pole-line is to be constructed with concrete poles. The actual work of making these poles has begun up at Marseilles. There is a great market for this surplus power. Up and down the valley are many concerns that will use a large amount of power regularly. These include the big cement mills at La Salle to the west and the Federal Plate Glass Company at Ottawa.

EXTENSIVE INDIANA-MICHIGAN MERGER—An extensive electric merger has been effected in Northern Indiana and Southern Michigan, whereby the Indiana & Michigan Electric Company has absorbed the St. Joseph & Elkhart Power Company, the Elkhart Electric Company, and the South Bend Electric Company. The capital stock of the St. Joseph & Elkhart Power Company is $250,000. The Elkhart Electric Company has a capital stock of $150,000, and the South Bend Electric Company has also a capital stock of $150,000. The Indiana & Michigan Electric Company will have a capital stock of $1,915,500, and its life is fifty years. The directors are: Charles A. Chapin, Henry K. Crawford, Homer C. Chapin, Hardin L. Crawford, Fred L. Dennis, Charles B. Calvert, Marshall L. Newell, Fred A. Bryan and Richard Talbot. By the terms of the merger, all of the big dams and power-houses of different companies along the St. Joseph river pass into the hands of the Indiana & Michigan Electric Company. The company will furnish power and light to Berrien, Cass, St. Joseph and Van Buren counties in Michigan and to Elkhart, St. Joseph and Laporte counties in Indiana.

REORGANIZATION OF THE UNITED STATES INDEPENDENT TELEPHONE COMPANY—Plans have been outlined for the reorganization of the United States Independent Telephone which is summarized as follows: First—Foreclosure of United States Independent and Independent Telephone Securities Company mortgages. Second—Appointment of a reorganization committee of three; organization of a new corporation with a capital of $6,000,000 to take over the foreclosed property; giving of a new mortgage to secure a bond issue of the maximum amount of $5,000,000. Third—Holders of United States Independent bonds to receive stock of the new company to the amount of forty per cent of their holdings—providing they subscribe for the new bonds to the amount of twenty per cent of their holdings. Fourth—Holders of the Independent Telephone Securities bonds to receive twenty-five per cent more stock than holders of the United States Independent bonds. Fifth—$3,000,000 of the authorized $5,000,000 to be issued at once and with proceeds all indebtedness to be liquidated and properties of the Rochester, Syracuse and Utica companies to be put in perfect condition. Sixth—In case of non-assent to reorganization plan by any bondholder their privileges to revert to assenting bondholders. Seventh—Plan not effectual unless agreed to by holders of ninety per cent of the bonds. Eighth—Assents must be given on or before September 15, 1907. It is provided in the reorganization plan to give a new mortgage to secure a bond issue of the maximum amount of $5,000,000, the bonds to bear interest at four per cent for the first year, five per cent for the second year, and six per cent thereafter, and the mortgage to cover all the shares of stock of the Rochester Telephone Company and the Stromberg-Carlson Telephone Manufacturing Company, now owned by the United States Independent Telephone Company, and covered by its mortgage, all the shares of stock and all the first mortgage bonds of the Home Telephone Company of Utica and the Independent Telephone Company of Syracuse, now owned by the Independent Telephone Securities Company, and covered by its mortgage, and all the bonds and other obligations to be purchased with the avails of the bonds of the new corporation, to be sold immediately as in hereafter provided. The plan also proposes to pay into the treasury of the Utica company $70,000 for its bonds for that amount.

LEGAL NOTE.

SELF-REGULATING TRANSFORMERS, STANLEY PATENT, No. 469,809—A preliminary injunction was issued on July 15 by the United States Circuit Court for the Southern District of New York in the case of the Westinghouse Electric and Manufacturing Company *versus* the Wagner Electric Manufacturing Company for infringement of Stanley patent No. 469,809, granted March 1, 1892. Under this decision, the Wagner Electric Manufacturing Company, of St. Louis, Mo., is forbidden to make, use or sell self-regulating transformers, which infringe this patent, anywhere in the United States.

NEW PUBLICATION.

"THE ART OF CUTTING METALS," by Frederick W. Taylor, M.E., Sc.D., which was the presidential address presented at the last annual meeting of the American Society of Mechanical Engineers, has been reprinted and bound in cloth by the society. Price $3. This or any other publication of the society may be had by addressing the secretary, 29 West Thirty-ninth street, New York. It is not necessary to send orders through members. None of the publications of the American Society of Mechanical Engineers are copyrighted.

DATES AHEAD.

Jamestown Tercentennial Exposition. Norfolk, Va., April 26 to November 30.

Ohio Electric Light Association. Annual meeting, Toledo, Ohio, August 20-22.

Michigan State Electrical Association. Battle Creek, Mich., August 20-22.

Canadian Electrical Exhibition. Montreal, Quebec, September 2-14.

Canadian Electrical Association. Annual convention, Montreal, Quebec, September 11-13.

Colorado Light, Power and Railway Association. Annual convention, Denver, Col., September 18-20.

Railway Signal Association. Annual meeting, Milwaukee, Wis., October 8-10.

OBITUARY NOTES.

MR. HOMER W. WYCKOFF died suddenly of pleurisy in Indianapolis, Ind., on Sunday, July 28. He was born in Detroit, June 28, 1871, and secured his early education in the Detroit public schools, graduating from the high school, later taking the electrical engineering course at the University of Michigan, and graduating with honors in 1895. His college course was interrupted by one year of service with the Detroit public lighting commission during the installation of the present municipal lighting plant. At the close of his college course he entered the employ of the Central Union Telephone Company as an expert conduit engineer and designer, with headquarters at Chicago, and had been with that firm ever since, rapidly advancing through his ability until, on the removal of the company's headquarters to Indianapolis, he was appointed assistant engineer, which position he held at the time of his death. He was a son of the late Robert Wyckoff, who was a well-known printer in Detroit for many years. He was the brother of Fred Wyckoff, Miss Jessie Wyckoff and Mrs. Alice Osborn. In June, 1898, he married Miss Janet Y. Van Dusen, of Detroit, who, with three daughters, survive him.

MR. JOHN C. HENDERSON, assistant to the president of the Louisville & Southern Indiana Traction Company, the Louisville & Northern Railway and Lighting Company and of the companies owning and operating the various utilities of New Albany, Ind., died at his home, 1113 East Elm street, that city, on July 23, of an affection of the throat, after an illness that had confined him to the house for nearly a year. He was sixty-three years old and is survived by three daughters, Mrs. A. D. Hobbs, of New York; Misses Ethel and Claire Henderson, of New Albany, his wife having died several years ago. Mr. Henderson went to New Albany about three years ago, having been appointed to the position of chief engineer in the construction of the approaches to the Big Four bridge at Jeffersonville, which were built for the use of the interurban trains in crossing from Indiana into Louisville. An evidence of his skill is that engineers of national reputation, who have examined the work since it was completed, have expressed their admiration for the originality and daring in which his plans were worked out to a successful finish. Two years ago he was appointed by Samuel Insull assistant to the president and had complete charge of the great interests in and about New Albany. Mr. Insull had the utmost confidence in his judgment and ability, and the same confidence was reposed in him by the syndicate of capitalists owning the property. He was a native of Scotland and had served great corporations in every part of the world, India and Australia being as well known to him as the United States.

NEW MANUFACTURING COMPANIES.

TRENTON, N. J.—The McArthur Electric Manufacturing Company, of Vineland, N. J., has been incorporated with a capital of $200,000 by Alexander P. McArthur, Luke J. Le Rolle and Edward J. McMullin.

COLUMBUS, OHIO—The Standard Gas and Electric Fixture Company, Cleveland. $10,000. Incorporators: T. W. Nubinger, F. Nubinger, R. G. Curren, George F. Downer and William F. Nubinger.

PASSAIC, N. J.—The Newman Electrical Company, Incorporated, has been formed to act as electricians and mechanical engineers. The capital is $10,000, and the incorporators: Charles R. Newman and Susan J. Ryan, Passaic, N. J.; Isaac White, New York, N. Y.

ELECTRICAL SECURITIES.

Last week's stock markets were painfully dull, with some disheartening features, principally manifested by way of a lack of enthusiasm over really encouraging developments. As predicted, the steel report for the quarter showed a splendid increase, with 7,600,000 tons of unfilled orders for finished material and a greatly improved condition of resources and reserve. So quiescent are matters in general that it is difficult to say what way the market balance will turn. From one quarter comes the opinion that considerable contraction will come about, while others hold the opposite view, that there is marked confidence evident in business circles, and that while reckless expenditures for enlargements are at an end for some time, there will be a steady grind of industrial development which will keep busy and prosperous all classes of people in all departments of work.

ELECTRICAL SECURITIES FOR THE WEEK ENDING AUGUST 3.

New York:	*Closing.*
Allis-Chalmers common	9⅛
Allis-Chalmers preferred	27
Brooklyn Rapid Transit	57
Consolidated Gas	117
General Electric	137
Interborough-Metropolitan common	15½
Interborough-Metropolitan preferred	43
Kings County Electric	117
Mackay Companies (Postal Telegraph and Cables) common	68
Mackay Companies (Postal Telegraph and Cables) preferred	66½
Manhattan Elevated	132⅛
Metropolitan Street Railway	85
New York & New Jersey Telephone	110
Western Union	78
Westinghouse Manufacturing Company	144½

During the year ended June 30, 1907, the lines of the Interborough-Metropolitan company carried a total of 929,900,256 revenue passengers, as compared with 885,363,869 carried the previous year.

It is understood that the Mackay companies availed itself of the decline in American Telephone shares which followed the recent issue of stock to average up its American Telephone holdings by securing several new blocks of stock. At the present time it is understood that the Mackay companies is the owner of nearly 90,000 shares of American Telephone stock. The present capitalization of American Telephone is $153,476,000, including the new stock, of which the Mackay companies hold less than 6 per cent, or about $9,000,000.

Boston:	*Closing.*
American Telephone and Telegraph	107¼
Edison Electric Illuminating	211
Massachusetts Electric	56
New England Telephone	107½
Western Telephone and Telegraph preferred	65

With the exception of New England Telephone, which fell off 1½ points, electrical stocks did very well at Boston, although trading was dull all through the week. Massachusetts Electric gained 1 point.

Massachusetts Electric report for the quarter and nine months ended June 30, show gross of $1,924,333; net, $672,156; interest and taxes, $449,498; surplus, $222,658.

Philadelphia:	*Closing.*
Electric Company of America	9¼
Electric Storage Battery common	50½
Electric Storage Battery preferred	51
Philadelphia Electric	8¼
Philadelphia Rapid Transit	20¼
United Gas Improvement	90¾

Philadelphia Rapid Transit directors wil make a call of $7.50 per share on the stock, payable September 9, and another and final assessment of $7.50 a share will be payable September 7, 1908. Each call will produce $4,500,000, which, when completed, will make the 600,000 shares full paid, $50 a share. The proceeds are to go for work on the subway and for general construction and betterments.

Chicago:	*Closing.*
Chicago Telephone	117
Chicago Edison Light	143½
Metropolitan Elevated preferred	64¼
National Carbon common	72½
National Carbon preferred	115
Union Traction common	—
Union Traction preferred	—

The Chicago Telephone Company gained 2,111 telephones during July. The total now in use is 192,264. Stockholders are subscribing readily to the $4,000,000 of new stock.

Figuring on 147 as the present market value of Chicago Edison stock, and 80 as the separate values of the new securities, the exchange works out as follows: 100 shares Chicago Edison at 147, $14,700; 10 shares new Chicago Edison at par, $1,000; total, $15,700; 110 shares Commonwealth-Edison stock at 89, $9,790; 66 shares Commonwealth-Edison certificates at 89, $5,874; total, $15,664.

The Union Traction Company's net earnings as reported to the court for nine months ended May 31 compares with twelve months ended August 31, 1906, 1905 and 1904 as follows: nine months, 1907, $756,061; twelve months, 1906, $1,429,752; twelve months, 1905, $1,055,079; twelve months, 1904, $712,093.

ELECTRIC LIGHTING.

WILMINGTON, DEL.—The Wilmington Electric Company is building an extension of its line to Newport.

NAUVOO, ILL.—Nauvoo has granted franchises for a trolley line, a waterworks system and an electric light system.

COTTAGE GROVE, ORE.—The Willamette Valley Company's electric plant at Cottage Grove has been completely destroyed by fire.

UPPER JAY, N. Y.—The contract for the building of the new power and lighthouse has been let to Nye Brothers. They will commence work at once.

CINCINNATI, OHIO—The Columbia Gas and Electric Light Company has notified council of its official acceptance of the franchise recently granted it, and has filled a $25,000 bond.

WHITEHALL, ILL.—The city council has granted a franchise to Dr. A. W. Foreman and J. B. Roberts for operating a system of electric lighting, heating and gas mains for a period of twenty years.

ST. PAUL, MINN.—The joint court-house and city hall commission has awarded to the McBride Electric Company for $2,095 the contract for installing electric lights in the city hall tower. The specifications call for 528 lights.

PASADENA, CAL.—E. F. Scattergood, associated with the Owens river project, has been secured by Pasadena to go over the entire municipal lighting system and to determine, if possible, whether the sum of $183,000 will be sufficient to complete the plant as proposed.

WALTER, OKLA.—The city council has granted a twenty-year franchise to an electric company composed of the leading business men of Chickasha and of this city. The company is to commence work on its plant before the expiration of thirty days and have the plant completed and in operation within six months.

NORTHBORO, MASS.—The contracts and agreements for lighting the streets with electricity have all been signed by the committee and the Marlboro Electric Lighting Company for ten years, the light to be in service by the last of October. The lighting committee is: George H. Felt, Clarence S. Buckley and H. M. Pienze.

MENOMONIE, WIS.—The Chippewa Valley Electric Light and Power Company is the only bidder for lighting the city of Menomonie for a term of seven years beginning next January. It offers to furnish all-night lights of 2,000 candle-power for $75 per year, or $70 if more than fifty arc lights are used. The present price paid is $86.87.

SEATTLE, WASH.—The city lights and lighting committee of the council has agreed to report to the city council a resolution directing Superintendent L. B. Youngs to prepare plans for the installation of 600 additional arc lights. The cost of the installation of these lights is to be borne out of the $600,000 secured from the sale of the lighting bonds.

BUFFALO, N. Y.—The stockholders of the Cataract Power and Conduit Company have elected the following directors: Edward D. Adams, New York; John Jacob Astor, New York; Charles R. Huntley, Buffalo; W. Paxton Little, New York; D. O. Mills, New York; DeLancey Rankine, Niagara Falls; Francis Lynde Stetson, New York; George Urban, Jr., Buffalo, and Edward A. Wilkes, New York.

ADRIAN, MO.—A new electric light company has been organized at Adrian and has purchased at trustee's sale the old light plant at that place. The new company will at once begin overhauling the plant and making extensive repairs. The officers of the new company are: John App, president; Sam Walls, vice-president; A. J. Lentz, treasurer; Frank Walters, secretary. The capital is $6,000.

JACKSON, MICH.—The Marquette County Gas and Electric Company has asked the council of Negaunee, Mich., for an extension of its street railway and lighting franchises. The present franchises run until 1921, and the Farwell interests want them extended to 1936. The object in asking for the extensions is to have the date of the expiration of the franchises correspond with the date of the expiration of the company's outstanding bonds.

ANNISTON, ALA.—The Decatur Light, Power and Fuel Company has been added to the chain of Alabama electric companies, of which the Anniston Electric and Gas Company, the Little River Power Company and the Electric Lighting and Power Company of Talladega are a part. The Decatur company has been purchased by the Electric Bond and Share Company, of New York. R. A. Mitchell is a director in the purchasing company. Mr. Mitchell is the personal representative of the company in these investments in Alabama power plants.

PHELPS, N. Y.—At a meeting of the board of village trustees permission was granted to the Niagara, Lockport & Ontario Power Company to cross Ontario and Newark streets with its high-tension line within the limits of the corporation. In consideration of this permission the company agrees not to erect towers within a certain distance of these streets, to string its wires twenty-five feet above the surface and to equip the towers with safety devices in case a wire should break. The company further agrees to defray all expenses that have been incurred by the board while this matter has been under consideration and to file a bond of $5,000 to indemnify the village against any action for damage.

PETERSBURG, VA.—The contract entered into by the city with the Virginia Passenger and Power Company for lighting the city with electricity involves an annual cost of about $13,000, or about $1,100 per month. The contract is for a period of three years, with the option of two years more. The city has 228 arc lamps, and the cost per lamp is $57 per year. The receivers of the Virginia Passenger and Power Company have been allowed $22,000 by court for the establishment of a new and improved lighting system in Petersburg, providing the city will take a five-year contract for lighting. As the city seems willing to enter into only a three-year contract, with the option of extension, the matter will probably have to be referred back to court.

OGDEN, UTAH—Ogden will build a municipal lighting plant. This was decided at the meeting of the city council on July 24, when a resolution was passed providing that the committee on lighting be given power and authority to make such arrangements and agreements necessary to secure a water power site and rights. The same committee was given authority to purchase the same at a cost not to exceed $5,000. The proposition in view is to take the water from the Ogden river near the Wilson sawmill in Ogden cañon and pipe it to a point about a mile below the north of the cañon. It is claimed that when this matter was first discussed the Utah Light and Railway Company made application to the state engineer to take all of the water from the river above that point. They have since abandoned the project.

SOUTHBRIDGE, MASS.—Attorneys Burdett, Wardwell & Snow of Boston, have filed a general conveyance of the property of the Southbridge Gas and Electric Company to the Webster Electric Company. The papers show that the consideration for the transfer is $1 and other valuable considerations, and that the Southbridge company conveys to the Webster company all the property of the Southbridge company, real and personal, which has heretofore not been transferred, including all lands, buildings, machines, tools, apparatus, poles, wires, cables, claims, demands, accounts, locations and all property. With the papers is a copy of a vote of the Southbridge Gas and Electric Company to the effect that at a special meeting of the stockholders of the Southbridge Gas and Electric Company, June 1, it was voted to transfer its property to the Webster Electric Company for $65,000, and accept in payment therefor, in exchange for 500 shares of the outstanding capital stock of the Southbridge company, 650 shares of the increased stock of the Webster company, or such part of the 650 as may be authorized by the board of gas and electric light commissioners, provided that the Webster company shall upon the transfer assume and be responsible for all debts and obligations of the Southbridge company.

ELECTRIC RAILWAYS.

MAYFIELD, KY.—A street railway franchise has been sold to J. W. Williams, representing the firm of J. W. Williams & Company.

NAUVOO, ILL.—The contract for the building of the Mississippi Valley Electric Railway Company has been given to the Federal Construction Company, New York.

NEW HAVEN, CT.—The new trolley line to Waterbury *via* Derby, Seymour and Naugatuck, completing the belt line through the county, has been opened for travel.

FITZGERALD, GA.—A syndicate of local and foreign capitalists has made application to the city council for a franchise for operating an electric car line in Fitzgerald and to near-by towns.

PEWAUKEE, WIS.—Blue prints have been prepared, showing the route of the new electric road for which a franchise is asked. The line will touch Pewaukee, Hartland, Nashotah and Okauchee.

WAYNESBURG, PA.—The Brownsville, Masontown & Smithfield Railway Company has placed on file at Uniontown, a mortgage for $3,000,000, in favor of the bondholders, with the Windsor Trust Company, of New York, as trustee.

SPRINGFIELD, ILL.—A meeting of the stockholders of the Springfield & Southeastern Traction Company will be held August 19, to consider a proposition to issue bonds for the construction of the system proposed by the company.

MADISON, WIS.—D. D. Ely, of New York city, has interested local capitalists in a proposition to build an electric road between this city and Janesville at a cost of $900,000. He expects to have the line in operation inside of eighteen months.

GOSHEN, IND.—Charles L. Henry and Edward Haskins have been named as appraisers to fix a value on the property of the Indianapolis, Huntington, Columbia City & Northwestern Company's property, which is to be sold at receiver's sale September 17.

SALT LAKE CITY, UTAH—Plans have been approved by the engineers of the Utah Light and Railway Company for the improvements to be made on the old Exposition Square. The estimates fix the expenditure at $635,639 for the buildings, tracks and other work.

EUGENE, ORE.—The Willamette Valley Company has sold its franchises for the Eugene street railway and the railway connecting Eugene with Springfield, together with all rights of way, easements and property connected with the lines, to A. Welch, vice-president of the company.

SANDWICH, MASS.—It is reported that a new street railway project is being undertaken, to serve the territory between Fresh Pond in Plymouth county and the town of Sandwich. Henry J. White, of South Hanson, has given notice that he intends to apply for a franchise.

MILWAUKEE, WIS.—It is stated on good authority that the new Frost road, the Chicago-Milwaukee electric road, will build a spur line from its main line to South Milwaukee, a distance of a mile and a half, over which it will operate cars to connect with all main line cars, east and westbound.

OKLAHOMA CITY, OKLA.—Plans for an interurban electric line between Oklahoma City and Norman have been completed by George Silsby, of Oklahoma City, who has left for the East to make arrangements to finance the deal. It is expected to have the new road in operation within six months.

HAMMOND, IND.—Work is progressing rapidly on the Chicago, Lake Shore & South Bend interurban line west of Gary to Indiana Harbor. The power-house is under construction at Michigan City, and it is believed that the road from South Bend to Kensington will be finished by April 1 of next year.

GREELEY, COL.—The Greeley & Denver Electric Railroad Company has reported that surveys for the road from Denver to Greeley and from Greeley to Johnstown are completed and surveyors are running lines in the Pleasant Valley district. The company has been successful in securing rights of way.

CINCINNATI, OHIO—A mortgage has been filed in this county from the Cincinnati & Columbus Traction Company, to the Union Savings Bank and Trust Company to secure a bond issue of $200,000. The money thus provided is to be used for present indebtedness and to make certain improvements incident to the extension of the property.

NEW YORK, N. Y.—It is the plan of the Interborough-Metropolitan Company to place in operation on the Fourth and Madison avenue surface lines within a short time several pay-as-you-enter cars. The cars are to be used on these lines for the purpose of ascertaining their feasibility. If found to be practicable they will be introduced on other lines.

HEMPSTEAD, N. Y.—Formal application has been made by the Sea Shore Municipal Railroad Company, for a franchise to build a trolley line on the roads leading from the intersection of Franklin and Front streets, Hempstead, through Ocean Side and Rockville Centre to East Rockaway and eventually from there to Long Beach. A portion of the route is over private land.

NEW YORK, N. Y.—The New York, Westchester & Boston Railway Company, which intends to build a four-track road for the operation of high-speed electric trains, has applied to the Supreme Court for permission to condemn lands for the right of way from Port Morris to Port Chester, by way of New Rochelle, with branches to White Plains and Fort Schuyler.

NASHUA, N. H.—The Hudson, Pelham & Salem Electric Road, one of the first lines built in the southern New Hampshire railway system, has been sold at auction for $400,000 to the New Hampshire Electric Railroad Company, successor of the New Hampshire Traction Company. The sale was a foreclosure in favor of the New York Security Trust Company, which held a mortgage for $435,872.

NEW YORK, N. Y.—Officials of the Carnegie Trust Company are considering a plan to finance an interurban traction enterprise for Nashville, Tenn. Plans have been submitted for the development of the trolley lines in that city and it is understood that about $2,000,000 will be involved. The report of the Carnegie Trust Company's expert who visited Nashville recently has not been presented to the finance committee.

PHILADELPHIA, PA.—The Philadelphia & West Chester Traction Company has opened its new line extending from the union station at Sixty-ninth and Market streets to Collingdale, where connection is made with the Darby & Chester division of the Rapid Transit Company. Connection is also made with the Delaware County & Philadelphia Electric Railway at Clifton for all points between Angora and Media.

LEXINGTON, KY.—A contract has been let to the Kaufman Construction Company of Salt Lick, which is a branch of the Kaufman-Shaw Construction Company, of Dayton, Ohio, incorporated in Kentucky recently, for the survey of the proposed electric railroad to be built through Sharpsburg, Carlisle and Owingsville to West Liberty *via* Olympian Springs, a distance of about sixty-five miles, and work has been commenced.

NEENAH, WIS.—The Wisconsin Light, Heat and Power Company has secured a through line from Kaukauna to Oshkosh. The track from Neenah to Oshkosh, fourteen miles, was secured July 15, when a deal was closed for the purchase of the Winnebago Traction Company's interest in the line. N. A. Freeman, general manager of the Wisconsin company, made the announcement. He said $250,000 was paid for the property.

ATLANTA, GA.—At a recent meeting of the directors of the Atlanta, Griffin & Macon Electric Railway Company, it was announced that the work of construction on the interurban trolley line from Atlanta to Macon would begin sometime in the near future, probably by fall. The securing of a few rights of way and other incidentals are all that remain to be done, and it is believed that these will be arranged during the summer.

RIVERHEAD, L. I.—A mortgage for $200,000 on the property of the Suffolk Syndicate Company has been recorded in the office of the county clerk by the Long Island Loan and Trust Company, of Brooklyn. The mortgage has twenty-five years to run. It is believed the mortgage was secured to build a trolley road from Patchogue, through the South Shore villages and towns, west. John R. Wells, of New York city, is president of the syndicate.

UTICA, N. Y.—The new electric railway from Utica to Binghamton is said to be assured. The line will run south from Utica, par-

alleling the Ontario & Western to a point near Sherburne and thence south through the Chenango Valley, opening up a fertile farming section. The line will extend through Hamilton. Experts have been examining the water powers on the Chenango river and are satisfied that an abundance of cheap power can be secured to operate the line.

WINTERSET, IOWA—Interest in the proposed Des Moines, Winterset & Creston interurban has been revived. Representatives of the company have started a movement to raise funds for the building of the road. They say it will cost $1,800,000, and that a bonding company has agreed to take over the project and build the road provided the promoters can raise $500,000 of this amount, to be made up of right of way, terminals, franchises and cash stock subscriptions.

NORTH YAKIMA, WASH.—At the inaugural meeting of stockholders of the Yakima Valley Transportation Company the franchise and assets of the Intervalley Traction Company were taken over by the new corporation, and A. J. Splawn was chosen president to succeed A. B. Scudder. The reorganization of the company was necessary for financial purposes. The new management will endeavor to get outside capital to insure early construction of an electric railway.

ROCHESTER, N. Y.—An official of the Buffalo, Genesee & Rochester Company, which proposes to connect this city with Buffalo by a double-track trolley line, says that work will be begun on the road late this summer or in the early fall. That portion of the line between Batavia and Depew will be built first, and will be in operation late in the fall of 1908. Work east of Buffalo may be begun next spring. The right of way between Rochester and Batavia has not yet been obtained.

RAVENNA, OHIO—J. W. Holcomb, of Cleveland, says that the bonds of the Cleveland, Alliance & Mahoning Valley Railway Company, have been sold and that the contract for the old Baltimore & Ohio main line between Ravenna and Newton Falls will be closed at once, final signatures having been delayed pending the financing of the proposition. Contracts will be made for electrifying this portion of the line as soon as these details have been completed, and for building nine miles from Newton Falls to Warren.

EL PASO, TEX.—The El Paso Electric Railway Company has bought from the International Water Company two tracts of land. The railway company will erect on the property a power plant costing $500,000, which will be sufficient to furnish power for the operation of street cars and the supplying of electric light in El Paso until the city has reached a population of 200,000. Work on the plant is to begin as soon as material can be secured and the company hopes to have the new power-house in operation within a year or fifteen months.

NEW LONDON, CT.—At the annual meeting of the stockholders of the Groton & Stonington Street Railway Company a board of directors was selected as follows: Benjamin A. Armstrong, Alfred H. Chappell and Charles R. Hanscom, of New London; Thomas Hamilton, of Groton; B. F. Williams, of Mystic; Charles W. Comstock, C. D. Noyes, Costello Lippitt and Edwin W. Higgins, of Norwich. A meeting of the directors followed, at which the following officers were elected: president, Thomas Hamilton; vice-president, B. F. Williams; secretary, C. D. Noyes; treasurer, Costello Lippitt.

WASHINGTON, PA.—As an evidence of the early construction of the street railway line from the terminus of the Washington & Canonsburg road at Canonsburg, to a connection with the Pittsburg railways system near Castle Shannon, there has been filed with the Washington county recorder a mortgage from the Pittsburg, Canonsburg & Washington Railway Company to the Safe Deposit and Trust Company, of Pittsburg, to secure bonds of $750,000 recently authorized. With the mortgage was filed an agreement between the Pittsburg, Canonsburg & Washington Railway Company and the Washington & Canonsburg Railway Company.

ANACONDA, MONT.—It is announced that work will begin shortly on an electric railway system for Gallatin Valley, in which St. Louis capital is interested. One of these lines starts from Bozeman and runs directly westward to the Ferris hot springs and thence southwesterly along the West Gallatin river until within a few miles of the Northern Pacific, when it turns west and goes direct to Manhattan. The other line goes from Salesville nearly direct north to Belgrade, crossing the Manhattan line near the Ferris hot springs. As there is no special difficulty encountered in securing the right of way, work on the line should begin within ninety days.

HAMMOND, IND.—F. N. Gavit, of Whiting, who recently outbid the Gary-Hammond Traction Company, an adjunct of the United States Steel Corporation, and was awarded a franchise to build five and one-half miles of street railway in Gary, Ind., has formed a traction company to build and operate the line. The company has been incorporated under the laws of Indiana, with a capital stock of $400,000. The franchise accepted by Gavit provides for three-cent fares, universal transfers, permission to operate interurban cars, and that the entire line shall be in operation within a year and a half. Gavit has guaranteed to have two and a half miles of the road ready for operation within eight months.

PERSONAL MENTION.

MR. THEODORE N. VAIL, president of the New York Telephone Company, has been elected a director of the American Surety Company.

MR. SIMON B. STORER, consulting electrical engineer, announces the opening of an office at 732 University Block, Syracuse, N. Y. Mr. Storer will specialize in power transmission, power contracts, commercial investigations, and reports.

MR. F. B. DUNCAN, formerly general superintendent of the Northern Electrical Company, and since then manager of the Akron Electrical Manufacturing Company, has resigned from that company to organize with Mr. H. C. Hale the firm of Hale & Duncan, contracting and designing engineers. Mr. Hale, who resigned as manager of the Mineral Ridge Manufacturing Company, to enter the new firm, was for many years mechanical engineer and designer of mining machinery for the Webster, Camp & Lane Company, and the Wellman, Seaver & Morgan Company, and since then manager of the Mineral Ridge Company. In the new firm, these gentlemen will give their principal attention to the electrical equipment of mines, especially the electrical operation of hoisting apparatus. Mr. Duncan will also continue to devote considerable of his attention to the field of motor-driven machine tools, in which he is a pioneer and has done much good work.

NEW INCORPORATIONS.

SPRINGFIELD, ILL.—Fulton County Telephone and Telegraph Company. To operate telephone and telegraph systems. $2,500. Incorporators: F. W. Plattenburg, M. J. Gorman, E. A. Heald.

COLUMBUS, OHIO—Toledo & Fort Wayne Electric Railway Company, Cleveland. $10,000. Incorporators: E. Jay Pinney, Herman J. Nord, Louis A. Goldstein, Thomas C. Willard and John E. Lowery.

NEW YORK, N. Y.—Hastings Electric Light and Power Company, Hastings-on-Hudson. Electric light, heat and power. $25,000. Incorporators: E. S. Perot, Yonkers; G. J. Jackson, C. Gallagher, New York City.

INDIANAPOLIS, IND.—The Kester Electric Company of Terre Haute. Capital stock reduced from $100,000 to $50,000; $5,000 in preferred stock has been issued. Number of directors has been reduced to five.

JERSEY CITY, N. J.—Capital City Power Company. To store, supply and convey water. $2,000,000. Incorporators: B. R. Higgins, Bloomfield, N. J.; Samuel Hartman, Manhattan, and Harry S. Leonard, Brooklyn.

AUGUSTA, ME.—Washington Telephone Company, Washington. $1,000. Promotors: Charles A. Lynch, W. F. Hatch, Lindley Murray Staples, Willis W. Light, Benjamin K. Ware, W. O. Luce, Albert E. Poland, Raymond Bowley, S. S. Bartlett, W. E. Overlock, H. E. Farrar, Washington; George Hall, North Union; Boardman E. Cunningham, Liberty; Hamlin Burkett, Burkettville.

TELEPHONE AND TELEGRAPH.

HAMILTON, WASH.—Owing to the rapid increase in population in the upper valley and the consequent necessity for better telephone facilities, the Sunset Telphone Company is now putting in a double line between Hamilton and Sedro-Wolley. The company found it necessary to better its service.

DES MOINES, IOWA—The Mutual Telephone Company, of Des Moines, Iowa, has increased its capital stock from $450,000 to $1,600,000, of which $1,000,000 is common stock and $600,000 preferred, of the par value of $30 per share. The issue is for the purpose of taking over and consolidating five outlying mutual systems.

MILWAUKEE, WIS.—The report that the Wisconsin Telephone Company would increase its rates throughout the state has been denied, and it is stated that the company's policy and aim is to reduce rather than increase its charges. In Kaukauna rates have been increased about fifty cents per month, but this has been because of the introduction of a full metallic circuit, the old grounded system having become undesirable.

PALOUSE, WASH.—Palouse is to have competition in the telephone business. Arrangements have been made for the erection of a one-story brick building, designed especially for telephone purposes, by the Interstate Telephone Company, successor to the Interstate Cooperative Telephone Company and various other rural and private lines all over the Inland Empire. The lines will be extended and up-to-date equipment put in. Interchangeable traffic arrangements have been made with the Home Telephone Company, of Spokane, so that patrons of either system may have the benefit of both.

COLUMBUS, MISS.—The Cumberland Telephone Company announces a change of rates for Columbus effective August 1. The new rates are increases. Business telephones will be $3.50 per month and residence telephones will be $2. While the increases are light, a big protest has been entered, and Secretary Sykes of the Progressive Union is threatening to ask the railroad commission to prevent the company from charging more. Superintendent Hume, of Memphis, has pointed out how the proposed rates are within the scope and points out that the new rate is fully justifiable by the new improvements. The new central-energy system has just been installed, and the entire system has been rebuilt. Mr. Hume says the company must raise the rates to have sufficient income for operating expenses.

CARTHAGE, TENN.—The Cumberland Telephone Company has been kept busy recently repairing its lines, which have been cut by unknown parties. The trouble seems to have arisen from a rule recently adopted by the company not allowing non-subscribers to talk over its lines without paying for it. Heretofore boxes have been rented to subscribers and any one who desired could talk over the exchanges in the county free of charge. This privilege has in many instances been abused to such an extent that the company was forced to make a rule cutting out non-subscribers. It has been ascertained that in one locality a box was rented by a subscriber and the rentals were paid to him by a number of parties living in that neighborhood, all of whom used the box freely. This has been done in a number of instances in other parts of the county and the company, in justice to itself, made the rule. The enforcement has caused quite a lot of friction, and at Riddleton fourteen of the company's lines were cut, completely severing connection between Carthage, Dixon's Springs, Hartsville and other important points.

BERLIN, N. H.—The Coos Telephone Company has acquired the business interest in Coos county of the New England Telephone and Telegraph Company. The exchanges are at Berlin, Gorham, Milan, Lancaster, Groveton, Colebrook, North Stratford, West Milan, Stewartstown, Whitefield, Littleton, Lisbon, Bethlehem and Fabyans. Connections with the lines of the New England Telephone Company will be maintained at several exchanges and with lines of the sub-licensees of the New England Telephone and Telegraph Company as heretofore. These connections enable the Coos Telephone Company to handle the business of the Connecticut valley to the county line, also that of Dixville, Errol, and the Magalloway region, the Androscoggin valley at Berlin, and the White Mountain country north of Franconia. A. C. Witte, late special agent of the contract department of the New England Telephone and Telegraph Company, with headquarters at Bellows Falls, Vt., is to be acting general manager of the Coos Telephone Company, with headquarters at Lancaster. A number of prominent business men of the county have become interested as directors, as follows: Walter Drew, Colebrook; John T. Amey, Lancaster; Henry T. Green, Littleton; John B. Noyes, Berlin, and John C. Hutchins, North Stratford.

INDUSTRIAL ITEMS.

THE JOSEPH DIXON CRUCIBLE COMPANY, Jersey City, N. J., will be pleased to send to interested parties some interesting and instructive literature concerning Dixon's graphite brushes.

THE JEWELL ELECTRICAL INSTRUMENT COMPANY, Chicago, Ill., has ready for distribution its catalogue devoted to electrical measuring instruments. This includes direct and alternating-current meters, portable, laboratory and switchboard instruments.

THE HOLOPHANE COMPANY (sales department), New York city, in bulletin No. 1, describes and illustrates the Holophane system of illumination. This gives a great deal of useful information in connection with the application of scientifically accurate globes and reflectors.

THE GOULD STORAGE BATTERY COMPANY, 341-347 Fifth avenue, New York city, has published a booklet describing and illustrating its couple-type batteries. This type of battery is particularly valuable where small amounts of current are required, as in operating police, fire-alarm, railway telegraph, and private telephone systems. The company will send the booklet to interested parties on request.

F. W. PARDEE has completed arrangements with the Wire and Telephone Company of America, of Rome, N. Y., under which he and his associates will act as the selling agents for the products of that company, which consist of "Romeoid" bare, tinned, silk, cotton, silk and rubber-covered wire, wire specialties, the "Easophone" and telephone supplies. Mr. Pardee's headquarters are at 56 Fifth avenue, Chicago, Ill. A complete stock will be kept in that city, to supply the middle western trade.

THE LOCKE INSULATOR MANUFACTURING COMPANY, Victor, N. Y., is calling attention to the satisfactory service of its insulators on the 60,000-volt line of the Washington Water Power Company, for which it furnished 33,500 "Victor" insulators, by the publication of a facsimile of a letter sent by the power company to the Electrical Testing Laboratories, New York city, commenting upon the inspection and test of the latter of the insulators involved, only one of which failed, by puncture, since the fall of 1903.

THE TRUMBULL ELECTRIC MANUFACTURING COMPANY, Plainville, Ct., has recently published a new bulletin describing and illustrating its type "A" switches, which shows a large extension to the line, and many changes and improvements are made. The bulletin covers thirty-four pages, and represents the most complete line of any one type of switches ever published. Four-pole switches are listed, also New Code fused switches with high fingers for fuses both on the hinge and handle end, and a complete line of switches for alternating current from fifteen to 2,000 amperes. The bulletin will be sent upon request to all those interested.

THE SPRAGUE ELECTRIC COMPANY, New York city, is mailing to the electrical trade and architects an attractive eight-page circular describing in detail new types of galvanized and enamelled stamped steel boxes and covers, and box fittings. The company has issued a second edition of price list No. 423, which includes several new types of fittings for use in connection with Greenfield flexible steel conduit and flexible steel-armored conductors. The publication of this edition has been necessitated through the addition of new types of boxes and box fittings and by the reduction in price of several types of boxes. Owing to these changes, new discounts on all conduit materials listed in price list No. 423 have also been sent to the trade.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., has issued catalogue A-12, covering Ward Leonard self-starters, showing its ALS type, comprising a self-closing switch, a self-starting rheostat, provided with no-voltage and overload release and protective interlock, preventing the automatic closure of the self-closing switch, except when the rheostat is in its initial position. The starter is controlled by two push-buttons, a starting push-button and a stopping push-button. The resistance is in the form of

Ward Leonard enameled resistance units. There is also shown the AS type self-starting rheostat, with plain no-voltage release, for use in connection with Ward Leonard self-closing main-line switch or float switch, etc. The resistance of this type is also of Ward Leonard enameled resistance units. In either case it is simply necessary to close the circuit and the machine does the rest. This catalogue is complete with specifications covering the features of design of "the most perfect type of self-starter."

THE AMERICAN INSTRUMENT COMPANY, Philadelphia, Pa., has published a new catalogue, No. 65, and is distributing it to the users of electrical measuring instruments. It is beautifully printed, profusely illustrated with halftones, and deals in a very comprehensive way with its complete line of high-grade instruments of both switchboard and portable types. The improvements found in "American" instruments are interestingly set forth, emphasis being placed on the interchangeability of "American" shunts and multipliers, and the excellent magnetic shielding qualities of the drawn soft steel cases used on switchboard types. Complete lines of round pattern and "long-scale" switchboard voltmeters and ammeters are listed with full data as to range and prices. Numerous diagrams give the dimensions required for drilling switchboards, etc. The well-known "American" portables are shown in the latter half of the book, together with a new line of standard voltmeters and ammeters for the most exacting laboratory work. Portable relays and galvanometers are also illustrated. Throughout catalogue No. 65 is quite in keeping with the high-grade instruments it describes and illustrates. It is up to date, and contains fifty-six pages of valuable instrument data.

Directory of Electrical and Allied Engineering and Scientific Societies.

(Published in the Second Issue of Each Month.)

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE. Secretary, L. O. Howard, Cosmos Club, Washington, D. C.

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AMERICAN ELECTROCHEMICAL SOCIETY. Secretary, Dr. J. W. Richards, Bethlehem, Pa.

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AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS. Secretary, Ralph W. Pope, Engineering Societies Building, 29 West Thirty-ninth street, New York city. Meetings fourth Friday of each month.

AMERICAN MATHEMATICAL SOCIETY. Secretary, F. N. Cole, 50 West 116th street, New York city.

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ASSOCIATION OF ELECTRIC LIGHTING ENGINEERS OF NEW ENGLAND. Secretary, P. C. Brown, Boston, Mass.

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CANADIAN STREET RAILWAY ASSOCIATION. Secretary, Allan H. Royce, president Toronto Suburban Railway, Toronto, Ontario.

CENTRAL ELECTRIC RAILWAY ASSOCIATION. Secretary, W. F. Milholland, secretary and treasurer Indianapolis Traction and Terminal Company, Indianapolis, Ind.

COLORADO ELECTRIC LIGHT, POWER AND RAILWAY ASSOCIATION. Secretary, J. F. Dostal, Denver, Col. Annual convention, Denver, Col., September 18-20.

CONNECTICUT STATE STREET RAILWAY ASSOCIATION. Secretary, F. W. Poole, Bridgeport, Ct.

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ELECTRICAL TRADES ASSOCIATION OF PHILADELPHIA. Secretary, E. A. Symmes, 810 Drexel Building, Philadelphia, Pa. Meetings, second and fourth Thursdays each month.

ELECTRICAL TRADES ASSOCIATION OF CANADA. Secretary, William R. Stavely, Royal Insurance Building, Montreal, Canada.

ELECTRICAL TRADES ASSOCIATION OF THE PACIFIC COAST. Secretary, Albert H. Elliott, Claus Spreckles Building, San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

ELECTRICAL TRADES SOCIETY OF NEW YORK (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall street, New York city. Board of directors meets second Friday of each month.

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INDIANA ELECTRIC RAILWAY ASSOCIATION. Secretary, P. H. White, Indianapolis, Ind. Monthly meetings, second Tuesday of each month.

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IOWA STREET AND INTERURBAN RAILWAY ASSOCIATION. Secretary, L. D. Mathes, Dubuque, Iowa.

IOWA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, C. C. Deering, Boone, Iowa.

KANSAS GAS, WATER AND ELECTRIC LIGHT ASSOCIATION. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Topeka, Kan., October 16, 1907.

KENTUCKY INDEPENDENT TELEPHONE ASSOCIATION. Secretary, W. G. Turpine, Henderson, Ky.

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MAINE STREET RAILWAY ASSOCIATION. Secretary, E. A. Newman, 471 Congress street, Portland, Me.

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NEW ENGLAND STREET RAILWAY CLUB. Secretary, John J. Lane, 12 Pearl street, Boston, Mass. Meetings held on fourth Thursday of every month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, Engineering Societies Building, 29 West Thirty-ninth street, New York city.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary R. Max Eaton, Niagara Falls, N. Y.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, R. N. Kimball, Kenosha, Wis. Next annual meeting, Milwaukee, Wis., January, 1908.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio. Next annual meeting, Toledo, August 20, 21 and 22.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, O. O. Welsheimer, Columbus, Ohio.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL AND STEAM ENGINEERS. Secretary, F. W. Bullard, Cleveland, Ohio.

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OLD TIME TELEGRAPHERS' AND HISTORICAL ASSOCIATION. Secretary, John Brant, 195 Broadway, New York city.

ORDER OF THE REJUVENATED SONS OF JOVE. C. B. Roulet, Mercury, Dallas, Tex.

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PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meetings, second Saturday of each month.

RAILWAY SIGNAL ASSOCIATION. Secretary, C. C. Rosenberg, Bethlehem, Pa. Annual meeting, Milwaukee, Wis., October 8-10, 1907.

RAILWAY TELEGRAPH SUPERINTENDENTS' ASSOCIATION. Secretary P. W. Drew, Wisconsin Central Railway, Milwaukee, Wis. Next annual meeting, Montreal, Canada, June 24-26, 1908.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

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UNDERWRITERS' NATIONAL ELECTRIC ASSOCIATION. Secretary Electrical Committee, C. M. Goddard, 55 Kilby street, Boston, Mass.

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VERMONT ELECTRICAL ASSOCIATION. Secretary, C. C. Wells, Middlebury Electric Light Company, Middlebury, Vt.

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WESTERN SOCIETY OF ENGINEERS (Electrical Section). Secretary, J. H. Warder, 1737 Monadnock Block, Chicago, Ill.

WISCONSIN ELECTRIC AND INTERURBAN RAILWAY ASSOCIATION. Secretary, Clement C. Smith, president Columbia Construction Company, Milwaukee, Wis.

WISCONSIN INDEPENDENT TELEPHONE ASSOCIATION. Secretary, J. C. Crowley, Jr., Superior, Wis.

Record of Electrical Patents.

Week of July 30.

861,249. ELECTRICALLY HEATED SAD-IRON. William J. Barr, Cleveland, Ohio. Flexible attachment is provided for the cord.

861,275. INSULATOR FOR ELECTRIC WIRES. Constantine Gallagher, Richmond, Va. A block insulator.

861,280. ELECTRIC SMELTING. Paul L. T. Héroult, La Praz, France, assignor to Societe Electro-Metallurgique Francaise, Froges, France. The charge is fed so as to form a magma below the electrode.

861,281. ELECTROLYTIC ALTERNATING-CURRENT RECTIFIER. Arthur S. Hickley, Manasquan, N. J. Heat-conducting members are provided.

861,282. ELECTROLYTIC ALTERNATING-CURRENT RECTIFIER. Arthur S. Hickley, Manasquan, N. J. One electrode is hollow and contains the other.

861,288. TROLLEY WHEEL. Edward H. Johnson, Cleveland, Ohio. The outer rim is separable.

861,310. ELECTROTHERMAL SWITCH. James G. Nolen, Chicago, Ill., assignor to Frank B. Cook, Chicago, Ill. An expansible material is enclosed within the casing of the thermostat.

861,315. FUSE. Ralph S. Peirce, Hinsdale, Ill., assignor to Peirce Specialty Company, Chicago, Ill. A porcelain tube encloses the fuse.

861,319. APPARATUS FOR ELECTROLYTIC REDUCTION OF METALS FROM ORES OR SALTS. Charles E. Robertson, St. Louis, Mo. Hollow carbon electrodes are mounted on a rotatable disc.

861,340. TELEPHONE APPARATUS. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. A non-inductive resistance prevents the kick from the magnet from affecting other apparatus.

861,343. INCANDESCENT-LAMP SOCKET. James J. Wood, Fort Wayne, Ind. A locking socket.

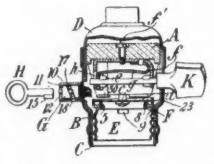
861,357. DEVICE FOR LOCATING DEFECTS IN TELEPHONE AND TELEGRAPH LINES. Gideon G. Buttler, Oklahoma, Okla., assignor of one-half to A. D. Marble, Oklahoma, Okla. A testing device.

861,365. RHEOSTAT. Frederick G. Jahn, New York, N. Y., assignor to the International Postal Supply Company, of New York, Brooklyn, N. Y. A starting rheostat.

861,445. ELECTRIC-LIGHT HOOD. Charles J. Eichhorn, Newark, N. J., assignor to the Tea Tray Company, of Newark, N. J. A hood and reflector for incandescent lamps.

861,459. TELEPHONE ATTACHMENT. Henry Gross, New York, N. Y. The mouth-piece is mounted on a slide.

861,468. CONTACT DEVICE WITH A SWINGING PLUG FOR ELECTRICAL CIRCUITS. Wilhelm Kreinsen, Burbach-on-the-Saar, Germany. The rosette is released when unduly strained.



861,343.—INCANDESCENT-LAMP SOCKET.

861,558. PROCESS OF FINISHING THE SURFACES OF ROLLS, DIES, ETC. Robert C. Totten, Pittsburg, Pa. The roll is electroplated with a hard metal.

861,560. ELECTRICAL KEYBOARD HEATER AND TONE PRESERVER FOR PIANOS AND ORGANS. Rose R. Turner and John C. Bernitt, Spokane, Wash. A heating resistance is placed under the keyboard.

861,587. SECTIONAL ELECTRICAL SWITCHBOARD. William D. Graves, Wheeling, W. Va. A sectional arrangement of bus-bars.

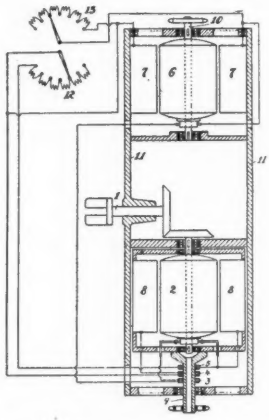
861,602. PHOTOGRAPHIC-PRINTING APPARATUS. Harvey H. McIntire, South Bend, Ind. A motor-driven printing device.

861,654. COVER-ATTACHING MEANS FOR ELECTRICAL FLOOR-BOXES. William F. Irish, Denville, N. J. A locking box cover.

861,692. SWITCH SOCKET FOR ELECTRIC LAMPS. Ernst Anderson, Chicago, Ill. The circuit is closed by turning the socket sleeve.

861,761. FIRE-ALARM SYSTEM. Newman M. Ogle, Walbrook, London, England. The alarm circuit is closed by a thermopile.

861,772. SIGNAL-CONTROLLING MECHANISM. Valentine I. Smart, Chicago, Ill., assignor to Union Switch and Signal Company, Swissvale, Pa. Electrically operated semaphore system.



861,931.—DYNAMO ELECTRIC VARIABLE-SPEED AND REVERSING GEAR.

861,782. PROCESS OF SEPARATING ORE. Henry H. Wait, Chicago, Ill., assignor to International Separator Company, Chicago, Ill. Porous material is impregnated with an iron salt and treated in a magnetic separator.

861,783. INTERRUPTER FOR ELECTRIC CIRCUITS. Reinhold H. Wappler and Charles F. Fayer, New York, N. Y. A mechanical interrupter.

861,790. CONTROLLER. Thorsten von Zweigbergk, Preston, England. A hoisting motor controller.

861,806. ELECTRODE FOR SECONDARY BATTERIES. Louis Chronik, New York, N. Y. The plate is built up of pairs of sections each formed of elliptical strips.

861,808. TELEPHONE SYSTEM. Henry P. Clausen, Chicago, Ill., assignor to American Electric Telephone Company, Chicago, Ill. A central exchange system.

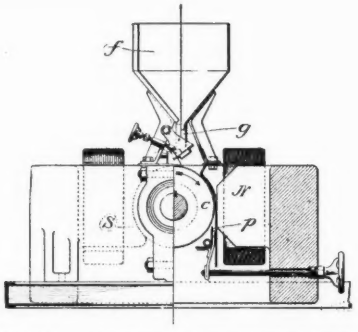
861,809. TELEPHONE SWITCHBOARD APPARATUS. Henry P. Clausen, Chicago, Ill., assignor to the American Electric Telephone Company, Chicago, Ill. A central energy switchboard.

861,813. JUNCTION BOX. Frank B. Cook, Chicago, Ill. A cylindrical sheet-metal box.

861,851. ELECTRICAL HEATER FOR HOT-WATER BAGS. Charles Van Dyke Hill, St. Louis, Mo. A slender heater.

861,856. ELECTRIC ARC LAMP. Hendricus J. J. Jaburg, Jr., Amsterdam, Netherlands. A lamp with inclined carbons.

861,887. HANGER FOR ELECTRICAL CABLES. Ralph S. Peirce, Chicago, Ill. A looped wire hanger.



861,782.—PROCESS OF SEPARATING ORE.

861,931. DYNAMOELECTRIC VARIABLE-SPEED AND REVERSING GEARING. Martin Albrecht, Friedberg, Germany, assignor to Felten & Guilleaume-Lahmeyerwerke Actien-Gesellschaft, Frankfort-on-the-Main, Germany. A combination of motor and generator.

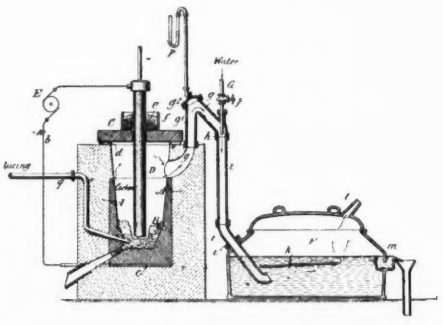
861,940. ELECTRIC-LAMP SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. A socket with a flange.

861,941. ELECTRIC-LAMP SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. A one-piece insulating base with binding screws.

861,942. ELECTRIC-LAMP SOCKET. Reuben B. Benjamin, Chicago, Ill., assignor to Benjamin Electric Manufacturing Company, Chicago, Ill. A lamp cluster.

861,965. SAFETY-FUSE. Carl Gehrke, St. Louis, Mo. An enclosed fuse.

862,041. CIRCUIT-MAKER AND BREAKER. John Wilkinson, Syracuse, N. Y., assignor to H. H. Franklin Manufacturing Company, Syracuse, N. Y. A rotatable breaker.



862,092.—MANUFACTURE OF PHOSPHOROUS AND CALCIUM CARBID.

862,072. SWITCHBOARD CONSTRUCTION. Theodore A. Hammond and William P. Hammond, Passaic, N. J., assignor to H. R. and K. Manufacturing Company, New York, N. Y. A telephone board.

862,084. RELAY AND SOUNDER. George W. Lorimer, Piqua, Ohio, assignor to the Lorimer Automatic Telephone Company, Augusta, Me. A method of construction.

862,092. MANUFACTURE OF PHOSPHOROUS AND CALCIUM CARBID. James T. Morehead, Leaksville, N. C., assignor, by mesne assignments, to Willson Laboratory Company, New York, N. Y. Metallic phosphates are smelted in an electric furnace.